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ANNUAL REPORT

OF THE

METROPOLITAN

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BOARD OF HEALTH

OF THE

STATE OF NEW YORK.

1869.

NEW YORK:
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90, 92 & 94 GRAND STREET.
1870.

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REPORT.

TO THE GOVERNOR OF THE STATE OF NEW YORK:

The Board of Health of the Metropolitan Sanitary District of the State of New York, composed of the counties of New York, Kings, Westchester, and Richmond, and the towns of Newtown, Flushing, and Jamaica, in the County of Queens, in accordance with the 19th section of Chapter 74 of the Laws of 1866, respectfully transmits its Fourth Report, which includes a review of its proceedings from November 1, 1868, to October 31, 1869.

The conditions affecting the public health during the year 1869 were as favorable as in the preceding three years. The last two months of 1868, November and December, gave the lowest death-rate recorded for many years; the mortality being only twenty in one thousand of the population in New York and Brooklyn. The months of January, February, and March, were marked by great alternations of temperature, the thermometer ranging 50° Fahrenheit in a single week. This was attended by an increased number of deaths from acute diseases, and affections of the respiratory organs. Scarlet-fever and measles, which caused but few deaths during the closing months of 1868, became unusually prevalent in the tenement-houses, and proved very fatal. Small-pox increased gradually in different parts of New York, and there was a severe outbreak of typhoid fever in East Eleventh Street.

During the months of April, May, and June, the weather was favorable for health; the temperature was very uniform, and frequent heavy rains cleansed the streets and filthy places. The general death-rate was low, but the total mortality was increased by the prevalence of certain contagious diseases. Scarlet fever and measles, which had prevailed in the tenement-houses during the preceding three months, but had been brought under control, now appeared in the better districts of the city, and caused a large number of additional deaths. Small-pox cases increased largely in April, and in May it became so wide-spread that it was evident that the present force of inspectors could not control it, and that an epidemic was impending. Prompt and decisive measures were immediately taken, and the records of June show that this most dreaded of all the contagious diseases was suppressed in the early part of that month.

The months of July, August, September, and October, had an unusually uniform temperature, but the average range of the thermometer was higher than for the same months of 1867, and but little below that of the corresponding months in 1868. The total mortality was less than either 1867 or 1868, Scarlet fever and measles had diminished to the minimum number of deaths occurring in the year, and small-pox cases were rarely reported. Diarrhœal diseases, generally so fatal at this season, were mild, especially in the tenement-house districts.

MORTALITY IN NEW YORK AND BROOKLYN.

The mortality in New York and Brooklyn, in 1869, compares favorably with the preceding three years of the Board's existence, as will be seen by the following table:

	1866.	1867.	1868.	1869.
New York, . . .	26,815	23,159	24,889	24,601
Brooklyn, ...	8,382	8,236	8,750	8,667

It thus appears that the total mortality of these two cities has somewhat declined during the past three years. This reduction of the death-rate is more marked if it is admitted that there has been an increase of population. It is an important fact that the mortality of New York has somewhat diminished during the last six years; for, in 1863, it was 25,196; in 1864, 25,645; and in 1865, 24,843.

In his analysis of the mortality records, the Superintendent traces the course of the death-rate during the year, and points out the causes and conditions upon which its fluctuations depend. The reduction of the total mortality by sanitary improvements, and the control and suppression of contagious diseases by the isolation of the sick, and the destruction of every means and source of infection, are amply illustrated. As a result of the thorough renovation and improvement of tenement-houses, the cleansing and ventilation of occupied basements and cellars, and the vacation of underground dwellings, he notes the diminution of the mortality by 1,500 among the occupants of the worst class of tenement-houses and cellars.

Scarlet and typhoid fevers were notably brought under control in the winter and spring months, by promptly following each case, and securing thorough cleansing and disinfection of rooms and clothing. Small-pox was suppressed by general vaccination, and the immediate care of each case, and the destruction, as far as possible, of all the sources of contagion.

GENERAL WORK OF THE BOARD.

The general work of the Board during the year 1869 far exceeds that of any preceding year both in amount and variety. In addition to the ordinary routine of duties, special investigations have been undertaken and completed, having for their object the thorough reconstruction of tenement-houses, the closure of uninhabitable cellars, the protection of the city against small-pox by systematic vaccination, the inspection of immigrant-vessels, the suppression of the sale of dangerous kerosene, the analysis of the milks brought to market and sold to families, the examination of the flour and bread used by the poor, the analysis of the air of public halls, schools, churches, etc., etc., the results of which will be found in detail in the Appendix.

The total number of original inspections made by the inspectors in New York was 51,218, and in Brooklyn 19,207. The following consolidated table exhibits the total subjects of these inspections and the results:

SUMMARY OF WORK FOR THE YEAR ENDING OCTOBER 31, 1869.

Matter and Place Inspected.	Total Inspections.	Causes of Complaint.	Matter and Place Inspected.	Total Inspections.	Causes of Complaint.
Tenement-houses	26,109	12,766	Streets, Gutters, and Sidewalks	1,464	347
Private Dwellings	9,157	697	Premises	24	
Public Buildings	125	11	Markets and Stands	26	1
Dangerous Buildings	65	70	Halls, Stoops, and Fences	5	
Boarding-houses	21	4	Squares	104	7
Cellars and Basements	4,631	1,832	Roofs	2	2
Manufactories	841	39	Rag-houses	2	2
Fat-rendering Establishments	194	11	Shanties	1,134	53
Gut-cleaning Establishments	11	6	Schools	2	
			Hospitals	3	
Bone-boiling and Crushing Establishments	9	1	Chemical Works	2	
Breweries	35	8	Gas-works	5	1
Distilleries	28	6	Lime-kilns	9	1
Malt-houses	1	1	Soap Manufactories	3	1
Swill-boiling Establishments	2	1	Offal-boats and Docks	20	1
Packing-houses	14	4	Piers, Docks, and Rescue Stations	89	16
Hides	2		Public Ferries	75	1
Tanneries	14	2	Immigrant and other Vessels	197	
Abattoirs	2		Contagious Diseases	918	8
Cattle-yards	1	2	Violations of Code	1,812	1,812
Slaughter-houses	247	82	Garbage-boxes	17	
Workshops and Stores	2,049	196	Manure Dumps and Vaults	83	31
Sunken and Vacant Lots	1,164	306	Smoky Chimneys	6	1
Horse and Cow Stables	2,854	433	Ponds	1	1
Yards, Courts, and Areas	3,921	1,096	Excavations	2	2
Waste-pipes and Drains	2,645	944	Cemeteries	1	1
Privies and Water-closets	9,790	1,747	Dead-houses	1	1
Cisterns and Cesspools	387	26			
Total				70,326	22,581

Whole number of reports received	28,321
Whole number of reports found correct	27,740
Whole number of reports returned for correction	581
Whole number of reports forwarded for orders	21,337
Whole number of general reports forwarded	1,759
Reports retained in Brooklyn	3,694
Whole number of complaints from citizens	4,038

EXECUTION OF WORK UNDER THE TENEMENT-HOUSE LAW.

In a digest of records relating to the execution of improvements under the Tenement-house Law, it appears in the Sanitary Superintendents' report that in 4,752 of this class of dwellings which were brought under improvement in New York, during the past twelve months, by order of the Board, there resided no less than 39,243 families, or an average of 8.25 families in each house. In the same houses it was reported by the medical officers that a strict application of the Tenement-house Law would require the introduction of 46,413 ventilating windows in bedrooms and halls; and the reinspections by the same officers, after the Board's orders had been put in the course of compliance, showed, on the 1st of November, that 39,270 of these ventilating windows had already been put in place in the houses.

The city of Brooklyn has only 2,500 tenement-houses, or about one-eighth as many as New York, and they are far smaller and less crowded; and during the past two years they have been brought into conformity with the requirements of the Tenement-house Law. Five hundred and thirty-two of these houses have been carefully surveyed during the past summer, in the same manner as in the tenement-dwellings of New York. The sanitary condition of these Brooklyn tenements was found to be generally so good that it was not deemed necessary to complete that survey in a greater number than is here mentioned; 424 out of the 532 houses were found in a thoroughly good condition, while 108 were in bad condition. The report of the Assistant Sanitary Superintendent for Brooklyn states "that this city contains no vast agglomeration of humanity under the worst hygienic conditions," but that "this survey points out clearly defects which have for the most part been remedied."

The number of filthy and untenantable cellars inspected and complained of in the 4,752 houses here mentioned was 599; some of which were so improved as to conform to the requirements of the Board, and some of which were ordered to be closed as habitations. The total number of reinspections which the Inspectors made while these various improvements were being made, and upon which they reported the kind and amount of constructive repairs or compliance, by indorsements on the original complaint, amounted to 7,105. These facts relate to the first 4,752 houses which were put under improvement in the year.

This merely statistical statement of one of the items of work executed may give some idea of the nature and results of official duties in the enforcement of the Tenement-house Law. In applying the requirements of that law to the nearly 20,000 tenement-houses houses in the city of New York, much yet remains to be done, and this kind of sanitary work can be accomplished systematically and upon a basis of exact information now that the sanitary survey of all the tene ments of the city supplies a complete record of the violations of the Tenement-house Law, and of sanitary wants in every such house.

REVIEW OF THE PROCEEDINGS OF THE BOARD.

November 1, 1868, to October 31, 1869.

The various subjects brought under the consideration of the Board, the action taken thereon, and the results which have followed, so far as ascertained, will appear from the following review of the proceedings of the Board for the year 1869:

Inspection of Food.—The Board having directed its Sanitary Officers to investigate and report upon the quality of the various kinds of flour and other ingredients employed in making bread, and the adulterations of the various breads offered for sale, the Sanitary Superintendent submitted a report upon the subject, on the 10th day of November, 1868, accompanied by reports of the Chemist and Deputy Registrar of Vital Statistics, containing the results of chemical and microscopical examinations of various samples of flour and bread furnished to them for that purpose.

Explosive Burning Fluids.—In consequence of the numerous and serious accidents resulting from the explosion of burning fluids, the chemist was, on the 10th day of November, directed to investigate and report upon the quality and kinds of burning fluid in common use, and whether any, and if so what, foreign ingredients of an explosive character were discovered. Seventy-nine specimens of kerosene were purchased from as many different retail dealers in various parts of the town, and submitted to the proper analysis and tests. Of this number seventy-eight samples were found unsafe. The dangerous ingredients were found to be benzine, gasoline, and naphtha, cheap oils which are employed by retail dealers to adulterate kerosene. The proportion of these oils to the kerosene in the samples examined varied from ten to ninety-eight per cent. The test used was fire, by which it can be determined at what temperture the oil evolves an imflammable vapor—the "vaporizing point," and the temperature at which oil itself may be kindled with a burning match—the "burning point." The vaporizing point of good kerosene should not be much below one hundred degrees Fahrenheit, nor its burning point below one hundred and ten degrees Fahrenheit. The tests of the samples purchased showed the vaporizing and burning points as low as eighteen degrees Fahrenheit. The chemist also examined the various kinds of cheap lamps in use, and found that, in the brass lamps, at the end of seven hours' burning, the fluid had reached a temperature varying from seventy-six degrees to one hundred degrees Fahrenheit, and in the glass lamps seventy-six degrees Fahrenheit.

A recent law of Congress fixed one hundred and ten degrees Fahrenheit for the burning test, but that law had been repealed. The fire laws of New York fix the burning point at one hundred degrees Fahrenheit, but that has proved too low, as is shown by the great increase in the number of burning casualties. To meet this defect in the law, the Board, on the 25th of January, adopted the following ordinance:

"No petroleum oil, kerosene oil, or other liquid, having like composition or qualities as a burning fluid as said oil, shall be kept or offered for sale as a burning fluid, for lamps or any like receptacle, for the purpose of illumination, nor shall such oil or fluid be purchased for use, or be used as a burning fluid for any such lamp or receptacle, or be kept for such use, unless all such oil or fluid shall be of such quality and ingredients that it shall stand and be equal to both the following tests and conditions, to wit:

"1. That it shall not take fire or burn at a temperature below one hundred and ten degrees Fahrenheit.

"2. That it shall not evolve an explosive vapor below one hundred degrees Fahrenheit."

Under this ordinance upward of four hundred retail dealers of adulterated kerosene have been brought into the courts of New York and Brooklyn. The number of dealers in adulterated kerosene is sensibly diminishing, as is shown by the gradual and very considerable improvement in the oils purchased for examination.

In the absence of adequate statutory provisions, and a class of officers especially designated for the purpose of restraining the illicit sale and storage of the cheap and explosive kinds of illuminating oils, the Board has used its best endeavors to discover the persons and places by whom and in which human life is endangered by violations of its ordinance on this subject. The exceedingly low price at which the dangerously explosive naphtha of petroleum may be had by any man, whose cupidity might tempt him to offer this fluid for illuminating purposes, makes it necessary that a more stringent and explicit law, relating to this subject, than any which now exists upon the statute-books of the State, should be promptly enacted and enforced. A special report upon this subject from the Sanitary Superintendent and the Chemist to the Board is herewith submitted.

Cellars and Underground Rooms.—With a view to enforce that part of the act for the regulation of tenement and lodging houses (Chap. 908, Laws of 1867) relating to vaults, cellars, and underground rooms occupied for lodging and sleeping purposes, the Sanitary Superintendent was directed, on the 12th day of November, 1868, to cause an inspection to be made of all vaults, cellars, and underground rooms occupied for purposes of lodging and sleeping in the cities of New York and Brooklyn, and report in each case the number of the street, name of the proprietor, and the conditions affecting the health of the occupants. The number of occupied cellars was found to be two thousand. Of these about one thousand were half above-ground, with good areas front and rear, and well lighted and ventilated; six hundred were two-thirds below the level of the sidewalk, with less or no areas, and hence had smaller windows and poor ventilation; while the remaining four hundred had their ceilings on a level with or below the sidewalk, and no ventilation possible except through the door, or, perhaps, through some hole in the wall. The difference in the class of people occupying these tenements is as great as the difference in the cellars themselves. In the first class the inspector generally found a single family, well supported, clothed, and fed. In the second there were generally two or more families, but ordinarily in good condition, having some trade or occupation which afforded the means of livelihood. In the third class, the real underground residents were found associating themselves together in large numbers in a single room. During the day they leave their miserable, loathesome dens, and earn, or beg, or steal sufficient to eat and wear, and at night resort again to these abodes, where they may be found at midnight packed together, men, women, and children, with little or no regard to modesty or to family relations.

The plan adopted to secure the desired reform was, to require the owners of the first two classes of cellars to make such improvements as would render them habitable, while the owners of the second class were to be compelled to vacate, cleanse, and close them as habitations. The first part of the plan has been executed with comparative ease. Upward of one thousand cellars have been cleansed and so reconstructed as to secure good homes to a population of at least seven thousand people. The effort to vacate the worst class of cellars has been attended with many difficulties. The occupants oppose all attempts to remove them above-ground, and the owners resist, as far as possible, the orders vacating their cellars. Partly by persuasion, however, through a cellar visitor, selected for his familiarity with this class of people, and partly by compulsion through the orders of the Board, the work has progressed satisfactorily, and over two hundred cellars have been permanently vacated and closed.

Public Urinals.—The Legislature of 1867 having appropriated the sum of three thousand five hundred dollars for the erection of public drinking fountains and urinals, under the supervision of this Board, a special committee was appointed in November to locate a public urinal. The committee selected a site at the junction of Eighth and Ninth Streets, in Astor Place, where a suitable building has been erected. The importance of this structure, in meeting the necessities of the public, is proved by the numbers which resort to it; though of large capacity, it is thronged during the entire day. It has been determined, by actual count, that upward of one thousand persons visit it daily. The appropriation of ten thousand dollars from the excise fund by the last Legislature, for the erection of additional urinals, will largely increase these great public conveniences.

Public Drinking-Hydrants.—On the 19th day of May the Board appointed a Special Committee to select suitable places for the location of drinking-hydrants, and to procure estimates of the cost of such hydrants when complete and ready for use; and, at a subsequent meeting, the same Committee was authorized to expend a sum, not to exceed five thousand dollars, in the erection of public drinking-hydrants. Under the direction of the Special Committee, hydrants of the most approved form were erected in the most public places in the city of New York during the summer of 1869. On the 7th day of July the Board adopted an ordinance, that no person shall destroy or injure any drinking-hydrant, or interfere with the use or enjoyment of the water therein; nor put any dirty, poisonous, medicinal, or any noxious substance, into such water or hydrant, by which the water is made dangerous or unwholesome as a drink.

Accumulation of Manure.—In December, 1868, the Board considered many applications for permits to dump manure, during the winter months, upon certain vacant lots and places on the North and East Rivers, and in all cases refused the applications. The nuisance resulting from the large accumulations of stable-manure was by this action materially abated. During the winter months, however, large accumulations of manure were made at the foot of Thirty-eighth Street and East River, and in several vacant lots on both sides of the city, in defiance of the ordinances of the Board. Orders were made upon the owners of this manure, requiring its removal, and many of those engaged in dumping were arrested. By these means all such accumulations were removed in the spring, and the city was for once entirely free from this nuisance.

Transportation of Manure.—Frequent complaints having been received in respect to the nuisance resulting from the manner of conducting the business of loading and unloading manure in the vicinity of the Long Island Railroad depot at Hunter's Point, the Board, on the 22d day of March, adopted an ordinance, prohibiting the loading or unloading of manure, garbage, or other like offensive matter, within three hundred feet of any passenger-car, having any passengers therein, or provided for passengers and about to depart; also prohibiting any car or vehicle, wholly or partially loaded with any such article, being placed or allowed to stand within the distance of three hundred feet of any such car, or of the place on the track where such car should arrive or depart, within half an hour of the actual or due arrival or departure of any such passenger car or train at or from such place. The Sanitary Superintendent was directed to cause frequent inspections to be made of the manner of conducting the business of loading and unloading manure at Hunter's Point, and the Attorney was also ordered to commence actions for penalties against all parties violating the ordinance above referred to, when furnished with evidence to that effect. On the 25th day of March the Board adopted an additional ordinance, prohibiting the turning or stirring (except about its removal) of any manure, garbage, or other material that is liable to emit offensive exhalations, in or adjacent to the built-up portions of any city or village of the Metropolitan Sanitary District.

Lime and Shell Burning Establishments.—On the 8th day of December orders were entered by the Board against the several lime and shell burning establishments in the cities of New York and Brooklyn, directing the business to be discontinued until it could be so conducted that no offensive odors should escape into the external air. The Attorney was also ordered to commence suits against the proprietors of all such establishments for violations of the code of Sanitary Ordinances. Hearings having been applied for under Section 14 of Chapter 74 of Laws of 1866, evidence was taken before a referee in respect to the condition of the several establishments, the manner of conducting the business, and the sanitary condition of the vicinity, which evidence was presented to the Board as the basis of the necessary action. After a careful consideration of the subject, the orders against such establishments as were located in the thickly-populated portions of the district were reaffirmed, and those located in the suburbs were allowed to continue the business upon the introduction of the most approved plans for rendering it inoffensive.

Rescue of Drowning Persons.—The Board continued to receive, during the past year, reports of the rescue of drowning persons by the life-saving apparatus prepared by the Board, and stationed at the several ferries and other places where human life is most endangered. Additions were made by order of the Board to the number of stations, and the apparatus has been kept in complete condition and repair. The returns of the police show that during the past season one hundred and eighty drowning persons were rescued and saved by this apparatus, and by the means of resuscitation taught to the force by an officer of this Board.

Manufacture of Illuminating Gas.—On the 13th day of December, 1868, the chemist was directed to report to the Board the results of the improvements in the manufacture of illuminating gas, introduced by the Metropolitan Gas Light Company, in their works, and to what extent the nuisance complained of had been abated. Upon the report of the chemist the Board directed the Attorney to continue the legal proceedings before ordered against the Company. The Company asked a hearing, which was granted, before the referee of the Board. At this hearing the subject of the manufacture of gas was exhaustively discussed by the chemist of this Board, and other eminent chemists introduced by the company. The body of evidence elicited by that examination is given in the Appendix. At the conclusion of this hearing a memorial was received from the Company asking for an extension of the time for making experiments to improve their works, and the chemist was ordered to make a weekly inspection and report as to the condition of the works of this Company, and the progress made in their efforts to improve their methods for the manufacture of illuminating gas. From these reports it appears that the Company made some efforts to improve their methods of manufacture, but nothing very effectual was accomplished.

By direction of the Board, the chemist, in October, examined all the manufactories of illuminating gas in New York, and reported upon their condition. Having, during the summer, visited the principal gas-works in Great Britain and France, he was able to make a comparison of the various methods employed in this city and abroad. From this report it appears that the iron process of purification is almost universally in use abroad. In this city it is employed only by the New York Company, and gives excellent results in its freedom from offence. The Manhattan Company has so perfected its dry-lime process as, in the opinion of the chemist, to be no longer a nuisance; while the Metropolitan Gas Company still creates a great nuisance, which, he believed, could be easily remedied by the methods employed by the other Companies. On receiving this report, the Board renewed legal proceedings against the last-named Company.

In the Appendix will be found a complete abstract of evidence on the whole subject of the purification of illuminating gases. All that has been claimed by the Board and its officers, in reference to needed improvements at the gas-factories, appears to be fully justified by the testimony elicited on the hearing of the Metropolitan Company.

Inspection and Survey of Tenement-Houses.—The importance of a thorough sanitary inspection of the tenement-houses of New York and Brooklyn has been recognized by this Board from its first organization. During the year 1866 an inspection of this class of dwellings was commenced; but the occurrence of cholera prevented the execution of any plan for such work. At the commencement of the present year the Board directed its Sanitary Committee to mature a plan for a thorough sanitary survey of all the tenement-houses in New York and Brooklyn, and appointed a sufficient number of inspectors to complete this survey before the beginning of another year. This work has been brought to a successful termination. Nearly twenty thousand tenement-houses in New York, besides the nearly two thousand in Brooklyn, have thus been brought under an exact system of registration of their structural and sanitary condition.

The plan of inspection pursued has been such as to bring every tenement-house under the most rigid examination. The city was divided into tenement-house districts, and to each an inspector was assigned. In the regular performance of his duty he was required to visit in succession every tenement-house in his district. In the inspection of the house he was directed to examine every room from cellar to attic, and make full and accurate notes of every material fact bearing upon the sanitary condition of the building in all its parts, and of every thing relating to the health and social condition of the occupants. These notes were rapidly made in properly prepared blanks. These blanks when filled were returned and placed on file in such form as to admit of easy reference for information. Whenever the inspector found sanitary defects which could be remedied he made such defects the subject of special complaint, and secured their prompt correction.

This systematic and exhaustive sanitary survey is now completed, and the results are embodied in the present annual report. The value of this inspection, it will be seen, is twofold: First, it has supplied the central office with a minute and accurate record of every tenement-house in New York and Brooklyn. That record embraces those facts relating to the house and the occupants so necessary to be known by the Superintendent in the daily routine of official duties, and in the administration of the ordinances of this Board. Second, this systematic house-to-house inspection has brought to light and removed thousands of domestic nuisances which never would have been discovered by the ordinary method of answering complaints. The thorough renovation of tenement-houses has been secured throughout both cities in a measure quite impossible by any other system.

Typhus Fever.—Reports having been received of the existence and prevalence of typhoid fever in East Thirteenth Street, the Board, on the 5th day of January, 1869, authorized the Sanitary Superintendent to remove to the fever hospital the persons sick, and to fumigate and disinfect the premises. Several cases of the same disease were also reported from various parts of the city. Each case was promptly visited by the officers of the Board, the sick person was sent to the hospital when practicable, the clothing disinfected, the rooms fumigated, and disinfectants liberally used in the privies and filthy places about the house. By these means the fever was soon limited, and lost its epidemic character.

Driving and Slaughtering of Animals.—On the 5th day of January the Board repealed all ordinances permitting the driving of cattle, sheep, and swine, in the city of New York, below Fortieth Street, and by ordinance prohibited the slaughtering of animals in the city south of said street. The butchers generally having, in July, 1868, stipulated to remove at this time their business to that part of the city north of Fortieth Street, the ordinance above referred to was enforced without opposition, and the Board granted permits to those establishments located near the East and North Rivers, which were found upon inspection to be in a cleanly condition, and possessing the facilities for the proper transaction of slaughtering. Applicants for permits were required to advertise their intention to erect and maintain slaughter-houses, thus giving to parties in the vicinity of the proposed locations opportunity to show cause why permits should not be granted. Frequent inspections of slaughtering establishments were made during the year, and permits were revoked in cases where uncleanliness and want of care in the transaction of the business were apparent.

Ventilation of Public Buildings.—The ventilation of theatres and other public buildings was the subject of a report of the Engineer submitted to the

Board on the 21st day of January, 1869; and a further investigation and report was ordered to be made under the direction of that officer, assisted by the Assistant Sanitary Superintendent of Brooklyn.

It will be seen by their report in the Appendix, that they examined the air of nearly all the theatres, and many of the schools and court-rooms, churches and halls in the district. These researches prove that the chief sources of impurity of the air in these various public rooms is carbonic-acid gas from respiration and the combustion of gas, and organic impurities. An amount of carbonic-acid gas was found in many instances, as in school-rooms and theatres, rendering the air very detrimental to the health of the occupants. The organic materials consisted in large part of the street dust rendered volatile, and fully fifty per cent. was proved to be the fæcal matters of horses. It was also found that the temperature of these public places was excessive, ranging often as high as ninety degrees Fahrenheit. The remedy for these evils is such a method of ventilation as will afford a proper supply of fresh air and heat, and distribute them uniformly. The plans submitted by the Engineer are designed to accomplish this purpose.

Nitro-Glycerine.—The Board considered, on the 25th day of January, 1869, the imminent danger to human life from the transportation of nitro-glycerine in the city of New York, and, being of the opinion that the subject of the protection of the city against nitro-glycerine is especially devolved by law on the Board of Metropolitan Fire Commissioners, directed that a copy of the reports of the Sanitary Superintendent and Chemist on the subject be forwarded to that Board for its consideration and the necessary action.

Drainage of Vacant Lots, Brooklyn.—On various occasions during the season of 1868–'69, the Board caused notices to be served upon the Board of Water and Sewerage Commissioners of Brooklyn, that certain pieces and parcels of land, dangerous to the public health on account of the stagnation of surface water thereon, required the immediate exercise of the powers conferred on said Board by Chapter 687, Laws of 1867. It is proper to state that the Commission referred to has promptly remedied these and all similar evils to which their attention has been called.

Permits to Emigrant-Vessels, and Inspection of Passengers.—The danger to the public health from the arrival at the port of New York of ships or vessels with immigrant passengers from places where disease subject to quarantine existed, received the necessary attention of the Board during the early part of the season of 1869. On the 19th day of May, the Board resolved to grant no permit to any such ship or vessel to come to the docks of New York or Brooklyn until the Sanitary Su [illegible] ssistant Sanitary Superintendent for Brooklyn shall [illegible] itary Inspector, have boarded said ship or ves [illegible] y person on board, and become satisfied, fro [illegible] person on board having any contagiou [illegible] communicate to any other person [illegible] ions, ev emigrant-vessel, and all vessels from infected ports arriving at New York, have been examined during the season. The total number of these inspections is as follows: Emigrant sailing-vessels, thirty-three, bringing four thousand four hundred and eighty-six passengers; emigrant-steamers, one hundred, bringing seventy-two thousand three hundred and ninety-five passengers. Notwithstanding the rigid enforcement of quarantine regulations by the Health Officer, there is always a liability that immigrants, exposed to contagious diseases, will reach the city and become the centres of infection. There is also great danger from infected clothing and bedding of ships which is frequently stored in the city, and sold to the poor. The inspector secured the destruction, by fire, of one thousand six hundred and seventy-five steerage beds, which had become dangerous from exposure to small-pox. In connection with the inspection of emigrant-vessels, the inspector examined the lodging and boarding houses of sailors and immigrants, the wharves and piers, the sewer-outlets, etc., obtaining much valuable information relating to the sanitary condition of our mercantile marine, and water fronts, which is embodied in the report of the Superintendent.

Diseased Swine.—A large number of diseased swine, *en route* from the West, having been slaughtered, their carcasses, upon their arrival in New York, were seized by an officer of this Board, and conveyed to the dock of the New York Rendering Company. On the 15th day of March the Board directed the Sanitary Superintendent to make a prompt and careful inspection of the hogs seized, and that all such as were found to be unsafe for human food should be under the care of an officer or agent of the Board until such disposition could be made of them as would preclude their being used as food, and that any portion of said hogs safe for food be left at the disposal of parties appearing to be entitled to them. Under the authority conferred by the Board, the Sanitary Superintendent procured such disposition of the dead animals that the public health did not suffer thereby.

Street Cleaning.—On the 15th day of March the Board instructed the Sanitary Superintendent to require the inspectors to report the names of those streets in their respective districts which, from their condition, require immediate cleaning. He was also directed to report to the Board from time to time the names of the streets which, in his judgment, require cleaning oftener than is provided for by the contract for cleaning the streets. At various times during the year the Sanitary Superintendent was authorized to clean and disinfect such streets and parts of streets as were found in a condition dangerous to the public health, and which required cleaning oftener than provided for by the city contract, the expense to be paid from a small appropriation made by the Legislature of 1867, for that purpose. The work consisted in thoroughly cleaning and washing out the gutters, and gathering street dirt into heaps for the contractors to cart away, excepting in certain streets from which the Board did the carting.

The total length of streets cleaned at the expense of the Board and paid for out of special funds averaged between forty-five and forty-eight miles per week. This work comprised the removal of the dirt from certain streets only, and in all other streets the dirt was swept and hoed into heaps, the gutters were cleaned and swept, and, until scarcity of water forbade, in September, the hydrants and hose were freely employed to wash out all filthy gutters. About one-fifth portion of all the streets between the Battery and Central Park were thus cleaned and disinfected, the aggregate length of these streets south of the Park being about two hundred and thirty-five miles. The Sixth, Fourteenth, Fourth, Tenth, Eleventh, Sixteenth, and Twentieth Wards received more of this extra cleaning than other wards, principally in the streets occupied by tenement-houses.

The gutters and most filthy portions of streets were disinfected. For this purpose the oil of coal-tar was largely used. It was sprinkled from ordinary sprinkling-cans. Quick-lime and chloride of lime were separately used, also, in places for which they chanced to be best adapted, and in certain quarters where excessive dampness and the production of sulphuretted gas prevailed.

The quantities of materials used in disinfecting streets amounted to two thousand six hundred and ninety-five gallons of heavy oil of coal-tar, two hundred and sixty-three casks of quick-lime, and one thousand nine hundred and fifty-two pounds chloride of lime. The total cost of this work was $3,547.54.

Care of Dogs having Hydrophobia.—Owing to the occurrence of several cases of hydrophobia among dogs in different parts of the district, the Board, on the 25th day of March, adopted a sanitary regulation making it the duty of the officers, agents, and men of the Metropolitan Police, to kill promptly every dog or other quadruped found in the sanitary district, which is in good faith believed to have the hydrophobia, or to have been bitten by any animal having such disease, and authorizing and directing said police officers to kill every dog appearing to be sickly, emaciated, or diseased, found in said district at large, and not in charge and appearing to be under the care and control of some owner or other proper custodian. The regulation above referred to also requires a report to be made to the Sanitary Superintendent, of every case of killing of any dog, by police officers, and when and where the same was killed, and also every case of any dog having, or which is believed liable to have, or has been exposed to hydrophobia, and when and where said dog was last seen or is likely to be found, and a description thereof, and the Board in said regulation assumes all the responsibility for such killing, pursuant to the 4th section of Chapter 956, Laws of 1867, providing such act shall be in good faith in the supposed discharge of duty.

Drainage of Vacant Lots, New York.—The accumulation of stagnant water upon the vacant lots between Fifty-ninth and Sixty-fifth Streets and Third and Fifth Avenues, caused by the obstruction of the natural water-courses, seriously endangered the health of residents in that vicinity during the early part of the season of 1869. On the 27th day of May the Engineer was directed to report the necessary facts and particulars upon which the Board could base the proper orders for the abatement of the nuisance, and on the 9th day of June orders were issued which required the opening of the old water-courses. This work, now completed, involved the construction of drains below the sewers already laid in several streets, and extended to Third Avenue, where the main drain entered the sewer. This drainage has had the effect to render the saturated soil of the several blocks overflowed dry and healthful.

Various other localities in the unoccupied portions of the city of New York were also relieved of stagnant water by measures inaugurated by the Board, and the improved drainage exercised a most favorable influence upon the health of the several neighborhoods.

Removal of Dead Animals, Brooklyn.—By reason of the failure of the proper parties to remove dead animals from the streets of Brooklyn, the Assistant Sanitary Superintendent for that city was, on the 12th day of April, ordered to cause the dead animals found lying in the streets, or public grounds, or places in that city, to be removed to some proper place, until the further order of the Board. Under arrangements made by that officer, the nuisance was promptly abated. Complaints having been received in respect to the nuisance from dead animals and offal upon the shores of the Bay, in the Eighth Ward, Brooklyn, the Board, on the 19th day of May, authorized the Commissioners resident in that city to cause the immediate removal of the offensive material. Unauthorized parties having commenced the business of rendering dead animals and other offensive animal matter upon a boat near the foot of 34th street, Brooklyn, the Board, on the 30th day of June, ordered said offal-boat to be immediately removed at least 3,000 feet from the shore of any part of the Metropolitan District. The owners of the establishment having failed to comply with the order of the Board, the Assistant Sanitary Superintendent of Brooklyn was, on the 23d day of July, directed to cleanse, disinfect, and fumigate this offal or rendering boat, and to cause its immediate removal.

On the 30th day of June, the Board adopted an ordinance, that no boat, or vessel, having on board or towing any offensive animal or animal matter, shall come within 1,000 feet, without a special permit of this Board, of any part of the shore, or of any pier or dock in the city of Brooklyn, or between said city and New York City and the Narrows, except as may be necessary for the reception and removal in due course of such offensive animals or matter, and that the process of rendering such animals and animal matter be not conducted without such permit at any point within one mile of the shore of the Metropolitan Sanitary District, north of the Narrows.

Houses unfit for Human Habitation.—On the [illegible] day of April, and at various other times during the year 1869, the Board ordered certain houses to be vacated pursuant to Section 11, Chapter [illegible], Laws of 1867, upon the certificate of the Sanitary Superintendent that such houses were, by reason of want of repair, unfit for human habitation.

Bones, Scrap, and other Refuse Matter.—Upon the report of the Sanitary Superintendent, in respect to the nuisance of [illegible] of receiving bones, scrap, and other refuse, upon [illegible] lying near the foot of West Thirty-eighth Street, N. R., the Board [illegible] day of April ordered the business to be discontinued until it should be so conducted as to be inoffensive, and until the parties engaged therein receive permits from this Board. Various improvements having been made in the boats and barges, as well as in the manner of conducting the business, the Board, on the 9th day of June, granted permits in the form recommended by the Sanitary Committee.

Glanders.—Numerous complaints having been made of the large number of horses suffering from glanders and farcy, on the 3d day of May the Board adopted an ordinance, prohibiting any person from keeping or retaining, at any place within or adjacent to the built-up portions of any city or village in the Metropolitan Sanitary District, any horse, ass, or colt, having the disease known as glanders or farcy.

Swine and Goats.—On the 19th of May the Board adopted an ordinance, prohibiting any person from allowing any swine or goat to run at large in any city; and from keeping any swine or goat, without the permit of this Board, within 1,000 feet of any residence or place of business in any city or village in the Metropolitan District.

Garbage on Vacant Lots.—On the 26th day of May the Board directed the Sanitary Superintendent to furnish such information, in respect to the dumping of garbage and other offensive material upon vacant lots, as to enable the Board to issue the necessary orders for the abatement of the nuisance. And at various other times during the year, the Board, by orders, suits for penalties, and, in some cases, by arrests for violations of the Sanitary Ordinances, succeeded in preventing the use of offensive material for filling vacant lots and constructing new streets.

Night-Scavengers.—In the month of June the Board caused a thorough inspection to be made of the carts and utensils used by night-scavengers, and a careful examination of the mode in which that important branch of sanitary work is performed in the district. All licenses to night-scavengers having been revoked, new licenses were issued to such parties as were found to possess carts and utensils of proper construction, and in complete repair, and who, by the observance of the rules in respect to cleanliness and disinfection, performed their work in a manner as inoffensive as the nature of the business would admit. In order to secure greater efficiency in the disinfection of the contents of privies, the chemist was directed to select the most suitable agent for this purpose. He reported that, on experiment, sesquichloride of iron was found to be the most powerful privy-disinfectant known. Accordingly, the Superintendent required the scavengers to employ this agent in suitable quantities, or an equivalent amount of some disinfectant of recognized power. The result of a careful superintendence of the work, and of the use of proper disinfectants, has been a marked relief from the inherent offensiveness of the business.

Analysis of Milk.—For the purpose of determining the purity of the milks supplied to New York by wholesale and retail dealers, the chemist entered upon an extended analysis of this article of food obtained from such dealers. The investigation was so conducted as to test the milk as found at all the great country depots, and as taken from nearly every retail dealer's cart. The results of this analysis will be found in the Appendix.

Small-Pox—Vaccination.—Owing to an increase in the number of cases of small-pox, on the 22d day of February the Board ordered ten thousand notices to be printed and posted, containing the names and locations of institutions at which any and all persons may be vaccinated free of charge. As a result of this notice, the number of persons applying for vaccination at the several dispensaries was largely increased.

Notwithstanding the care of the Board to thoroughly isolate every reported case of small-pox, and disinfect the rooms of the sick, and their clothing and bedding, and vaccinate every person exposed to the infection, this disease gradually increased in New York during the winter months, and in May appeared in so many new and widely-separated localities, that the Board had good reason to apprehend an epidemic of small-pox. The history of small-pox in New York for the last sixty years shows that, at periods varying from three to five years, it has been epidemic, and that these epidemics vary in intensity according to the amount of vaccination. The last epidemic occurred in 1865, and since that period vaccination has been greatly neglected, as appears from the inspection of several of the public schools by the Inspectors. The number of unvaccinated sometimes exceeded fifty per cent. There can be no doubt that New York was ripe for such an epidemic as had visited it so frequently heretofore. The danger was also increased by the unusual prevalence of small-pox in California, and in many large Western towns, and in Canada. To these sources of exposure must be added the emigrant-vessels which at that time were crowded with passengers, and nearly all of which brought many cases of small-pox. To meet this emergency, it was determined to offer vaccination to the entire city by systematic house-to-house visitation. Accordingly, the Board, on the 27th day of May, appointed sixty Assistant Sanitary Inspectors to aid the officers of the Board in the immediate vaccination of all persons requiring the same, and authorized the Sanitary Committee to purchase the necessary vaccine virus. The work was completed in six weeks. The total number of persons vaccinated was upward of thirty thousand, and it is estimated that an equal number were vaccinated at the dispensaries, and by physicians. The number of families visited was one hundred and fifty thousand, and the number to whom vaccination was offered did not fall far short of seven hundred thousand persons. The result was most satisfactory: the number of cases of small-pox began to diminish as soon as the work was fairly begun, and during the following summer and autumn the city was as free as usual from the disease.

During the period of vaccination in New York the Inspectors in the country districts were supplied with vaccine virus, and directed to offer free vaccination. This action led to the vaccination of large numbers in the different districts, especially where small-pox had appeared.

Straw, Bedding, etc., from Vessels.—On the 7th day of July the Board adopted an ordinance that no owner, part-owner, charterer, agent, or consignee of any vessel, nor any officer or person having charge or control of the same, shall allow to be cast therefrom into any public waters of the Metropolitan Sanitary District any straw, bedding, clothing, or other substance from any foreign port, or port south of Cape Henlopen, without a permit from the Board, except as allowed by Quarantine regulations.

Accidents upon Street Railroads.—The frequency of accidents, by reason of persons getting upon or off the front platform of horse-cars while the same are in motion, appearing to indicate a needless exposure of life, the Board invited each of the companies owning or running such cars in the Metropolitan Sanitary District, to appoint a representative to meet with the Board on the 14th day of July, for the consideration of the proper means for remedying the evil referred to. After hearing the statements of the officers of the several railroad companies, it appearing that no practical plan or device is yet known for the entire prevention of accidents of this character, the Board postponed the consideration of the subject until additional information and facts could be collected upon which to base the required action.

New York Rendering Company.—On the 14th day of July, and at subsequent meetings, the Board considered the testimony taken in the case of the New York Rendering Company, located at the foot of West 38th Street, and engaged in the business of rendering and utilizing the dead animals and offal collected in the city of New York, under a contract with the city authorities.

After a careful consideration of the facts in the case, and of the relative extent of the measures necessarily resulting from the dead animals and offal of the city, whether collected and removed daily from the city, or consumed by the process employed by the New York Rendering Company, the Board, on the 22d day of September, resolved to issue a permit to said company to conduct its business at the foot of West 38th Street until the 1st day of May, 1870, provided the same be conducted by present or improved methods, in a manner least prejudicial to the public health, which may be practicable; it being expressly understood that the company will before that date secure a new location, and construct such new buildings as will insure the practical removal of the nuisance complained of. On the 22d day of October the Board adopted a form of permit to the New York Rendering Company, containing rigid and specific restrictions as to cleanliness and care in the transaction of its business.

Garbage and Garbage-Boxes.—On the 18th day of July the Sanitary Superintendent and the Assistant Sanitary Superintendent, Brooklyn, were directed to give particular attention to the enforcement of that part of the sanitary code relating to the proper care of garbage, and were authorized to incur the necessary expense in printing and circulating notices in respect to the same. On the 27th of October the Engineer was directed to examine the subject of garbage-boxes, with reference to the best style and form of the same, and to report to the Board.

The result of this effort to secure better care of garbage among the tenement-houses has been very favorable. The kind of garbage receptacle best adapted to the wants of the mass of people was decided to be a barrel or half-barrel. The instructions given by means of the notices distributed by the Superintendent have been generally followed, and the nuisance created by throwing the garbage into the streets has been considerably abated. The garbage, however, cannot be properly disposed of until the ashes and swill are separately stored, and both are systematically removed and utilized.

Management of Tenement-Houses.—The necessity of bringing the tenement-houses under more stringent local government, led the Board to direct the Sanitary Committee to examine into the present management of tenement-houses, and report such improvements as were deemed necessary. On the 8th of September the Committee reported that they had made extended tours through the tenement-house districts of the city, and had made personal exination as to the management and condition of the larger buildings of this class. In general, they found that the worst class of tenement-houses were those where a landlord had accommodations for ten families, and these buildings comprise more than half of the tenement-houses of the city, and accommodate fully two-thirds of the entire tenement-house population. Where the number of families living under one owner exceeded ten, it was found that such owner was engaged in the keeping of a tenement-house or tenement-houses, as a business, and generally as a speculation. He was seeking a certain percentage on his outlay, and that percentage very rarely fell below fifteen per cent., and frequently exceeded thirty per cent. It is among this class of tenement-houses that nearly all the evils of the tenement-house system in New York are found. In whatever part of the city the Committee visited these establishments, with a few exceptions hereafter to be noticed, the same conditions existed. The little colony exhibit in their rooms, and in the areas around their dwellings, extreme want of care. The street in front of the place was reeking with slops and garbage; the alleys and passage-ways were foul with excrements; the court was imperfectly paved, wet, and covered with domestic refuse; the privies, located in a close court between the rear and front houses, were dilapidated, and gave out volumes of noisome odors, which filled the whole area, and was diffused through all the rooms opening upon it; and the halls and apartments of the wretched occupants were close, unventilated, and unclean. The complaint was universal among the tenants that they are entirely uncared for, and that the only answer to their requests to have the place put in order, by repairs and necessary improvements was, that they must pay their rent or leave. Inquiry often disclosed the fact that the owner of the property was a wealthy gentleman or lady, either living in an aristocratic part of the city or in a neighboring city, or, as was occasionally found to be the case, in Europe. The property is usually managed entirely by an agent, whose instructions are simple but emphatic, viz., collect the rents in advance, or, failing, eject the occupants.

The Committee were of the opinion that the public health requires that all tenement-houses, or groups of contiguous houses having the same owner, having accommodations for ten famileis or upward, should be placed under the supervision of a superintendent, housekeeper, or overseer, selected and compensated by the owner, who, as the accredited agent of the property, shall be held responsible to this Board for the faithful execution of the provisions of the Tenement-house Act, and of such ordinances and regulations relating to tenement-houses as this Board may from time to time adopt. The report was referred to the Counsel, who reported that the Board had no legal power to enforce such an ordinance or regulation.

Washington and Fulton Markets.—On the 4th day of August the Sanitary Superintendent was directed to make, or cause to be made, a thorough inspection of Washington and Fulton Markets, and the stalls and stands around them, and report what modifications and improvements are necessary to place these markets, stalls, and stands, in a proper sanitary condition. The facts obtained prove that these markets are totally unfit for their purposes. The structures are in the last stages of decay and dilapidation, and are impregnated with the foul emanations from the accumulated filth which underlies them. All kinds of vegetables and meats undergo rapid changes when placed in them, and are soon rendered unfit for human food. Most of the stalls and stands around the markets were found in a similar condition.

The reports of the Superintendent were referred to the Attorney for examination, and report as to the power of the Board in the premises. The Attorney reported that, while the time fixed by the Act of the Legislature of 1867, forbidding the Board from taking steps toward the removal of the stands and stalls, prior to July 1, 1869, had expired, the injunctions of the Court still remained in force, and the Board could not proceed except against stalls and stands not protected by the injunctions. Orders were accordingly made against such stalls and stands.

During the year 1869 four new and admirably-arranged markets have been opened in portions of the city where market accommodations were greatly needed, viz.: East 34th Street Market, between 2d and 3d Avenues; Croton Market, on East 42d Street, between Lexington and 4th Avenues; and Central Market, on 48th Street, between 7th Avenue and Broadway. A fourth market, of still larger dimensions, is about to be erected at the foot of 34th Street and North River. An important improvement has also been made in the Fish Market, at Fulton Market, by the erection of a new and commodious building. These new markets are supplying a great sanitary necessity of New York, and their organization has met the cordial approval and support of this Board.

Water Supply for Cleansing.—The attention of the Board was called to the question of an increased water supply to the city of New York, for sanitary cleansing, from the failure of the sources of the Croton during the past summer. At a period when the danger to the public health from decomposing filth around the homes of the poor, and in the streets and public places, was greatest, the usual water supply so far failed as to render necessary the most stinted use by the public, and the complete prohibition of its employment on the streets. If, in such an exigency, any of the more fatal and wide-spread epidemics should be prevalent, the result would be most disastrous to the public health.

In view of these facts, the Board, on the 8th of September, directed the Engineer to report a plan, with the necessary details and estimates, by which the city can be supplied with river-water for purposes of cleansing. The report (see Appendix) embodies a mass of facts, relating to the supply of water from the adjacent rivers of great practical value and importance. It appears that it is not only possible to derive an inexhaustible supply of water from the rivers for sanitary uses, but that the necessary works would not be expensive, in comparison with other public works. And especially does the cost appear insignificant when we consider the far-reaching benefits which would follow the completion of such an enterprise. The value of this new water supply is not limited to street and house cleansing, but would add greatly to the facility with which public baths could be supplied to the laboring-classes in the quarters where they would be most accessible. The Engineer also shows how this water supply can be utilized. As a means of extinguishing fires, it would have a power far greater than fire-engines, and might, if thus employed, not only save the Croton water, but reduce to a minimum the expenses of the fire department. It would also furnish a motor-power to commercial and manufacturing houses of great importance.

Management of Offensive Trades.—The Sanitary Committee to which was referred the reports, complaints, and papers, relating to fat-melting, tallow-rendering, and other offensive trades, on file, reported, July 29th, that among the first acts of this Board, after its organization in March, 1866, was the sanitary inspection of all the offensive trades in the cities of New York and Brooklyn. This inspection was made in response to numerous and urgent complaints of citizens as to their unhealthiness. The reports of the Inspectors show that these trades were conducted in a very loose and irregular manner, and that they were undoubted sources of disease. The proprietors of the various establishments readily consented to comply with the regulations of the Board, and introduce such improved methods of manufacture as would, it was believed, effectually prevent all nuisance.

During the subsequent three years this Board has maintained a strict sanitary surveillance of all the manufactories where offensive trades have been carried on, and allowed the work to be continued only under a permit which required that no nuisance should be created. The evidence before the Committee shows that the proprietors have, generally, in good faith, endeavored to so perfect their processes as to render their works harmless. New and costly machinery has been introduced, disinfectants have been liberally employed, and every suggestion of chemists and experts has been followed to accomplish the desired object. And though great and most important improvements have followed, yet imperfections in machinery, and carelessness in its management, render these trades far too offensive to be longer continued or tolerated in the immediate vicinity of human habitations. The complaints of citizens continue unabated both in number, character, and emphasis. The most recent reports of the Sanitary Officers prove that the nuisances from these sources remain unabated. The Committee recommended that those offensive kinds of business should be finally discontinued in all the built-up portion of the Metropolitan Sanitary District.

The Board adopted, on the 4th day of August, a Sanitary Ordinance (which was amended on the 22d of September), to the effect that on and after the 1st day of October, 1869, no person shall boil any fat, tallow, or lard (except at once upon the same being taken from the animal, and while the same is fresh and otherwise inoffensive), nor shall the storage or keeping of scrap, fat, or grease, or offensive animal matter, be permitted or conducted at any place in the city of New York south of 110th Street, nor in the built-up portion of the city of Brooklyn; nor shall the business of boiling or rendering fresh lard, fat, or tallow, be conducted within either of said cities without a special permit from the Board. On the 29th day of September all permits previously granted to melt or render fat were revoked, and the Sanitary Superintendent was directed to reinspect all establishments of this character, and report to the Board. On the 13th day of October the Board adopted a form of permit for fat-melting, containing the necessary instructions to secure cleanliness, and the use of the most approved methods and fresh material only, and all applications for permits to conduct this kind of business were referred to the Sanitary Committee for examination and report. On the 27th day of October, permits in the form approved by the Board were granted to three large establishments, located on the North and East Rivers, to continue their business, the same being considered comparatively inoffensive, and daily inspections of all places having such permits were ordered by the Board.

Permits for Slaughtering.—On the 6th day of October the subject of granting permits to slaughter animals was referred to the Sanitary Committee, to report thereon, with a view to the better regulation of the same. On the 27th day of October the Committee submitted a report recommending that no permits be hereafter granted to slaughter-houses located between the First and Eleventh Avenues, nor within one hundred feet of any avenue, and the report was approved and adopted by the Board.

The Employment of Disinfectants.—During the past summer disinfectants have been largely employed to render innocuous every species of organic matter which could not be promptly removed. In order to secure the kinds of disinfectants best adapted to particular forms of putrescent animal and vegetable matter, and kindred sources of nuisance, the Board directed the Chemist and Superintendent from time to time to make proper tests of different disinfectants. Under the supervision of the Superintendent the most approved disinfectants have been liberally employed, and with most satisfactory results. The gutter-filth in all the tenement-house districts was treated with disinfectants weekly. In those parts of the town where privies are least cared for, and are most offensive and dangerous to the public health, disinfectants were regularly taken from house to house by employés of the Board, and by them so thoroughly applied to these festering sources of disease, as for the time to destroy all foul emanations. This service among the tenement-houses was gratefully acknowledged by the occupants. In several instances important main sewers opening into slips where ferries were located, the discharged sewage from which was a source of extreme offensiveness, were treated with large quantities of disinfectants, which temporarily relieved the nuisance. Disinfectants have also been liberally applied to the stagnant water of undrained places where malarial fevers prevailed.

Care of Contagious Diseases.—The success of the Board in suppressing contagious diseases depends much upon the faithfulness of physicians in reporting cases promptly upon their coming under observation, and the permission of the friends of the sick to have every source of contagion and infection destroyed. The measures adopted by the Board in cases of contagious disease are to immediately isolate, as far as practicable, the sick; to cleanse and fumigate, when necessary, the room and house; to disinfect and cleanse the clothing, and destroy all discharges and all sources of foul emanations about the sick. In cases of small-pox the sick are immediately taken to the Small-pox Hospital, unless they can be placed under proper care and isolation at home. All persons exposed to the contagion are vaccinated, including those in adjacent houses. When typhus and typhoid fever are reported, the sick are sent to the Fever Hospital, unless provided with good homes, and the same care is exercised in regard to the clothing, etc. Scarlet fever and measles are diseases which are always treated at home, for the want of proper institutions for the reception and care of those suffering from them; but every effort is made to limit the spread of the contagion.

The ability of sanitary officers to greatly mitigate, if not entirely suppress, these pestilences by preventive measures, if they could be promptly and efficiently applied, is not doubted by this Board. But physicians and friends of the sick are frequently loath to report these cases, and irretrievable injury may be done by the dissemination of the germs of the contagion before the existence of the disease is known to the Health authorities. This negligence on the part of some physicians to perform a plain duty, and, in some instances, their intentional evasion of the law, is highly reprehensible. Instances are not wanting where contagious diseases have thus gained a firm foothold, and many lives have been lost through the neglect of physicians to report the first cases.

But it not unfrequently happens that the friends of the sick refuse to have those measures carried out which are necessary to destroy the contagion, and prevent the exposure of others. On this account, it is often found possible to deal much more effectually with contagious diseases among the poor than among the wealthy. During the spring months scarlet fever and measles were much more completely controlled, and consequently were much less fatal, among the poorer than the wealthier classes. Where resistance is met with, it is overcome by persuasion rather than by force.

Quarantine.—The past year has been remarkable for the large increase in immigration. The danger to the public health from the importation of contagious diseases has required great vigilance on the part of the Health Officer and his subordinates. Early in the season small-pox began to appear among the immigrants, and the fact that in many seaport towns of Europe this disease was unusually prevalent, caused no little anxiety lest the city should become infected from this source. But the danger was averted by the prompt action of the Health Officer in securing immediate vaccination of the passengers and crews of vessels in which small-pox had appeared, and by disinfection and fumigation of the vessel. Vessels from the West Indies frequently brought yellow fever into port during the summer months, but the care taken at quarantine to cleanse and disinfect them was so efficient, that the public health suffered no detriment from this source.

CHANGES IN THE BOARD.

On the 12th day of January, 1869, Dr. Edward B. Dalton resigned his position as Sanitary Superintendent, and on January 18, 1869, Dr. John T. Conkling resigned his position as Assistant Sanitary Superintendent of Brooklyn. In accepting the resignation of these officers the Board passed resolutions acknowledging the value of their past services, and expressing the interest of the members in their future welfare and success. Subsequently Dr. Elisha Harris was elected Sanitary Superintendent, Dr. Moreau Morris, Assistant Sanitary Superintendent for New York, and Dr. R. Cresson Stiles, Assistant Sanitary Superintendent for Brooklyn. On the 3d day of May official information was received of the resignation of Thomas C. Acton, as Police Commissioner, and by virtue of that office a member of the Metropolitan Board of Health. Resolutions were unanimously adopted by the Board, expressing the great regard of the members for their late associate, both as a man of honor and integrity, and as an active, faithful, and capable public officer. Henry Smith having been elected a Commissioner of Metropolitan Police in place of Thomas C. Acton, resigned, took his seat as a member of the Board, on the 10th day of May.

ORDERS OF THE BOARD.

The orders of the Board for the abatement of nuisances, drainage, etc., made upon application of local authorities, citizens, and upon the reports of inspectors in the portions of the sanitary district other than New York and Brooklyn, were more numerous, and covered a much larger territory in 1869, than any preceding year of the Board's existence. These orders have generally led to the immediate abatement of nuisances, and to works of improvement and drainage of great value to the several localities where such works have been performed. The General Drainage Act, passed by the last Legislature, is of great importance to those large sections of the district where malarial diseases most prevail, and which can only be remedied by extensive drainage. During the past season the officers of the Board have, as far as practicable, brought this law to the attention of those most interested in drainage, and urged them to proceed under it.

During the year ending October 31, 1869, the number of orders issued by this Board was ten thousand nine hundred and seventy-eight. Of this number, one thousand eight hundred and eighty-seven orders were issued under the first subdivision of Section 14, of Chapter 74, Laws of 1866, by the terms of which the party served is allowed three days in which to demand a "hearing" by the

Board of the testimony which may be presented to show that the order should be modified or revoked. In cases where no hearing has been asked for, and the order has not been complied with, "final" orders in the original or an amended form, to the number of six hundred and thirty-four, have been issued and forwarded to the Sanitary Superintendent, or to the Board of Metropolitan Police for execution; or the Board has directed the Attorney to commence suits for penalties for non-compliance with such orders. All other written orders, in number eight thousand four hundred and fifty-seven, have been issued under the second subdivision of Section 14, of Chapter 74, Laws of 1866, and are of a peremptory character, requiring that the nuisance be abated within five days, and if not complied with, directing the Sanitary Superintendent to enforce the same without further notice. The following is a statement of the subjects of the orders above referred to:

Acetic acid (business of manufacturing) discontinued	3
Alleys cleaned	64
" disinfected	15
" graded	24
" paved	28
" repaired	6
Animals (dead) removed (number of orders).	10
Areas cleaned	79
Ashes, filth, garbage, etc., removed (number of orders)	1,097
Balusters repaired	5
Basements cleaned	13
Blood (business of packing) discontinued	1
Bone and offal (business of boiling)	6
Bone and scrap (business of storing)	4
Bridges (gutter) repaired	13
Bridges (gutter) made	19
Ceilings cleaned and whitewashed	125
Cellars cleaned	[illegible]
" connected with sewer	21
" disinfected	[illegible]
" drained	31
" filled	7
" graded	1
" vacated	[illegible]
Cellar door repaired	6
Cellar grating repaired	9
Cesspools cleaned	[illegible]
" connected with sewer	[illegible]
" covers made for	[illegible]
" disinfected	[illegible]
" emptied	[illegible]
" filled	[illegible]
" made	[illegible]
" repaired	[illegible]
Chimneys extended	[illegible]
" repaired	[illegible]
Cisterns, covers made for	[illegible]
" disinfected	[illegible]
" emptied and cleaned	[illegible]
" filled	[illegible]
" repaired	[illegible]
Cows removed (number of orders)	[illegible]
Croton pipes repaired	[illegible]
Culverts made	[illegible]
" (obstructions in) removed	[illegible]
Ditches cut	[illegible]
Drains cleaned	[illegible]
" filled	[illegible]
" made	[illegible]
" (obstructions in) removed	[illegible]
" repaired	[illegible]
Excavations filled	[illegible]
Fat (business of boiling) discontinued	[illegible]
Flagging in yard repaired	[illegible]
Floors (house), repaired [illegible]	[illegible]
" (privy), repaired	[illegible]
" (stable) repaired	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible] repaired	[illegible]
[illegible]	[illegible]
Gutters (house) repaired	60
" (obstructions in) removed	58
" (sidewalk) repaired	3
" (street) cleaned	86
Gutter-stones reset, etc.	199
Halls cleaned	41
" whitewashed	27
Horses removed (number of orders)	10
Hydrants removed	3
" repaired	84
Leaders connected with sewer	27
" extended	83
" (new) made	86
" repaired	147
" (obstructions in) removed	4
Lots cleaned	113
" connected with sewer	172
" disinfected	73
" drained	191
" filled	451
" graded	380
Man holes covered	3
Manure (business of manufacturing) discontinued	4
Manure depots removed	2
" removed (number of orders)	339
" vaults cleaned	5
" connected with sewer	[illegible]
" constructed	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
" repaired	15
[illegible] removed (number of orders)	6
[illegible]	109
[illegible] removed (number of orders)	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible] removed	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	115
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	17
[illegible]	18
[illegible]	109
[illegible]	51
[illegible]	31
[illegible]	15
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

Privy vaults repaired	213
Rags (business of storing) discontinued	1
Railings made	6
" repaired	4
Roofs cleaned	6
" repaired	103
Sewers repaired	8
Sewer-pipes constructed	11
" obstructions in, removed	2,890
" repaired	3,610
" trapped	26
Shell and lime burning (business of) discontinued	8
Shutes (coal) covered	14
" (privy) removed	8
Sidewalks cleaned	88
" reset	71
Skylights repaired	8
Slaughtering (business of) discontinued	4
Slaughter-houses cleaned and disinfected	7
Spaces (vacant) cleaned	51
" " filled and graded	15
Stables cleaned	24
" removed	4
Stable floors graded	7
Stagnant water removed (number of orders)	114
Stairways repaired	26
Stoops repaired	84
Swill-boiling (business of) discontinued	1
Tanks cleaned (number of orders)	4
Urinals cleaned	8
" constructed	8
" repaired	8
Vaults cleaned	8
" disinfected	8
Walls cleaned and whitewashed	85
" constructed	6
" repaired	52
Water-closets cleaned	68
" connected with sewer	201
" constructed	201
" disinfected	47
" removed	8
" repaired	87
Yards cleaned	558
" disinfected	155
" drained	24
" filled	12
" graded and repaired	98
" paved	14
" (stable) cleaned	5

EXPENDITURES.

It will be seen, by reference to the detailed report of the Treasurer, that the sum of $149,999.22 has been expended in the entire Metropolitan District. There has also been expended, in the special work of tenement-house visitation and in the extra efforts to prevent the spread of small-pox, the sum of $16,778.01. This amount is taken from the special appropriation made in 1866, to be spent in the city of New York. In the execution of the orders of the Board a much smaller amount has been expended than usual, owing to the fact that the orders of the Board have been more cheerfully and promptly complied with. It will also be observed that the sum of $9,194.09 has been received for violations of the Tenement-house Law, and for penalties in suits for non-compliance with orders of the Board.

Respectfully submitted:

GEORGE B. LINCOLN, *President.*

EMMONS CLARK, *Secretary.*

TREASURER'S REPORT.

NEW YORK, *November* 1, 1869.

To the Metropolitan Board of Health:

I have the honor herewith to submit the accompanying Report in detail of the receipts and disbursements of the Board for the year ending October 31, 1869:

RECEIPTS.

Fund for New York County.

Appropriation for 1869	$110,186 15	
Interest on balances in Bank	106 04	
		$110,292 19

Fund for Kings County.

Appropriation for 1869	$37,333 85	
Interest	466 56	
		37,800 41

Fund for Richmond County.

1869.		
Mar. 31. Amt. collected by Attorney for violation.		10 00

Fund for Town of Newtown.

1869.		
Appropriation for 1869	$300 00	
Oct. 6. Amt. collected by Attorney for violation	5 00	
		305 00

Fund for Town of Morrisania

1869.		
Appropriation for 1869	$[illegible] 00	
Jan. 5. Amt. collected by Attorney for violation	10 00	
" 26. " " "	10 00	
Feb. 8. " " "	10 00	
Mar. 1. " " "	10 00	
Apl. 20. " " "	10 00	
Oct. 6. " " "	[illegible] 00	
		[illegible] 00

Fund for Town of West Farms.

Appropriation for 1869	$300 00

Fund for Town of Westchester.

Appropriation for 1869	300 00

Fund for Town of Greenburg.

Appropriation for 1869	450 00

Fund for Town of Cortland.

Appropriation for 1869	300 00

Fines and Penalties, New York County.

		Amount collected by Attorney—	
1868.			
Dec.	12.	For violations..................	$502 00
	14.	do	90 00
	28.	do	565 00
1869.			
Jan.	5.	do	462 00
	11.	do	369 05
	25.	do	204 00
Feb.	1.	do	60 00
	8.	do	275 00
	15.	do	746 28
Mar.	1.	do	188 00
	9.	do	241 50
	15.	do	240 00
Apl.	26.	do	321 30
1869.		Amount collected by Attorney—	
May	19.	For violations..................	$500 05
June	4.	do	285 00
July	9.	do	953 24
Aug.	16.	do	609 30
	17.	do	280 00
	18.	do	431 37
Sept.	17.	do	346 50
	30.	do	375 50
Oct.	6.	do	297 00
	13.	do	180 00
	22.	do	130 00
	27.	do	100 00
			$8,752 09

Fines and Penalties, Kings County.

1869.			
Mar. 23.	Amount collected by Assistant Attorney for violation	$17 00	
June 2.	Amount collected by Assistant-Attorney for violation	100 00	
July 15.	Amount received from Justice Walsh for fines............................	103 00	
Aug. 3.	Amount received from Justice Walsh for fines............................	45 00	
Sept. 3.	Amount received from Justice Walsh for fines............................	90 00	
Oct. 27.	Amount collected by Attorney for violation	2 00	
			$357 00

Fund for Special Expenses in New York County.

(See Chapter 837, Laws of 1866.)

1869.		
Jan. 22.	Amount received for orders executed by Disinfectant Department..............	$35 79
Mar. 23.	Amount received for Disinfectants, sold by order of Sanitary Superintendent.......	167 16
July 9.	Amount received for Horse sold by order of Sanitary Superintendent	75 00
Oct 30.	Do. Do.	200 00

Oct. 30.	Amount received for old Furniture sold by Property Clerk	9 74	
"	Interest on Bank Balances	522 54	
			$1,010 23

Fund for Execution of Orders in New York County.

(See Section 14, Chapter 74, Laws of 1866.)

1868.	Am't rec'd from owner, for execution of—			
Nov. 16	Order	No.	34	$340 92
19.	do	No.	4.414	3 00
19.	do	No.	3.742	21 75
20.	do	No.	155	252 02
23.	do	No.	100	378 83
27.	do	No.	531	8 23
Dec. 2.	do	No.	4.413	3 00
5.	do	No.	32	26 70
8.	do	No.	4,018 and 4,034	50 00
10.	do	No.	731	14 75
10.	do	No.	1.493	12 00
15.	do	No.	554	13 50
15.	do	No.	912 and 913	27 20
18.	do	No.	1,434	36 00
21.	do	No.	896	13 40
30.	do	No.	734	10 84
30.	do	No.	560	13 00
1869.				
Jan. 7.	do	No.	7.488	78 50
7.	do	No.	10.005	33 86
7.	do	No.	3.422	15 75
7.	do	No.	6.957	14 51
7.	do	No.	6.958	14 51
7.	do	No.	7.788	10 70
7.	do	No.	3.081	20 75
7.	do	No.	7.476	10 50
15.	do	No.	6.457	6 39
Jan. 15.	do	No.	4	$398 81
15.	do	No.	518	5 25
15.	do	No.	33	20 00
20.	do	No.	2,396	18 25
26.	do	No.	81	34 20
Mar. 13.	do	No.	3,392	20 43
27.	do	No.	1,825	24 85
30.	do	No.	121	177 16
April 8.	do	No.	3.880	68 00
21.	do	No.	380	256 68
21.	do	No.	6.568	10 55
May 5.	do	No.	124	296 25
June 9.	do	No.	11.275	22 20
July 9.	do	No.	306	375 00
9.	Rec'd in satisfaction of lien on premises of W. F. Brady			75 00
	Rec'd from owner, for execution of—			
July 22.	Order	No.	13	20 55
23.	do	No.	594	10 00
Aug. 16.	do	No.	3.835	163 37
18.	do	No.	7.257	26 43
Sep. 13.	do	No.	3.090	12 65
Oct. 4.	do	No.	848	20 70
30.	do	No.	5.738	23 25
30.	Interest on Bank Balances			254 61
				$ 3,624 90

Fund for Execution of Orders in Kings County.

1869.		
Oct. 30.	Interest	$145 42
		$164,017 24

RECAPITULATION.

Fund for New York County	$110,292 19	
Fund for Kings County	37,800 41	
Fund for Richmond County	10 00	
Fund for town of Newtown	305 00	
Fund for town of Morrisania	370 00	
Fund for town of West Farms	300 00	
Fund for town of Westchester	300 00	
Fund for town of Greenburg	450 00	
Fund for town of Cortland	300 00	
Fines and penalties, New York County	8,752 09	
Fines and penalties, Kings County	357 00	
Fund for special expenses in New York County	1,010 23	
Fund for execution of orders in New York County	3,624 90	
Fund for execution of orders in Kings County	145 42	
		$164,017 24

DISBURSEMENTS.

GENERAL EXPENSES.

Salaries.

Health Officer—		
John Swinburne, from October 1, 1868, to October 1, 1869		$500 00
Treasurer—		
Benjamin F. Manierre, from October 1, 1868, to October 1, 1869		500 00
Secretary—		
From November 1, 1868, to November 1, 1869		3,000 00
Counsel—		
From October, 1, 1868, to October 1, 1869		5,000 00
Attorney and Clerk—		
From November 1, 1868, to November 1, 1869		3,000 00
Engineer—		
From November 1, 1868, to November 1, 1869		4,000 00
Chief Clerk—		
From November 1, 1868, to November 1, 1869		1,000 00
Sanitary Superintendent—		
E. B. Dalton, for November, 1868	$416 66	
E. B. Dalton, for December, 1868	416 66	
E. B. Dalton, from January 1 to January 12, 1869	166 66	
E. Harris, from January 21 to November 1, 1869	3,902 78	
		4,902 76
Corresponding Secretary—		
From November 1, 1868, to November 1, 1869		1,000 00
Analytical Chemist—		
From September 1 to November 1, 1868, at $500	83 33	
From November 1, 1868, to November 1, 1869	2,000 00	
		2,083 33
Treasurer's Bookkeeper—		
From November 1 to December 1, 1868, at $800	66 66	
From December 1, 1868, to Nove'ber 1, 1869, at $1,500	1,375 00	
		1,441 66
Treasurer's Clerk—		
From November 1, 1868, to November 1, 1869		1,500 00
Clerks to Secretary—		
Pay roll for November, 1868	$908 33	
do December, 1868	908 33	
do January, 1869	908 33	
do February, 1869	908 33	
do March, 1869	908 33	
do April, 1869	908 33	
do May, 1869	783 33	
do June, 1869	783 33	
do July, 1869	933 33	
do August, 1869	933 33	
do September, 1869	783 33	
do October, 1869	783 37	
		10,450 00
Clerks to Sanitary Superintendent—		
Pay roll for November, 1868	$425 00	
do December, 1868	425 00	
do January, 1869	425 00	
do February, 1869	425 00	
do March, 1869	425 00	
do April, 1869	425 00	
do May, 1869	550 00	
do June, 1869	550 00	
do July, 1869	400 00	
do August, 1869	400 00	
do September, 1869	525 00	
do October, 1869	400 00	
		$5,375 00
Janitor and Messengers—		
1 Janitor, from November 1, 1868, to November 1, 1869	900 00	
1 Messenger, from November 1, 1868, to November 1, 1869	720 00	
1 Messenger, from November 1, 1868, to November 1, 1869	168 00	
		1,788 00
		45,540 75

Stationery and Printing.

1868.			
Nov.	24.	M. B. Brown & Co	$13 50
	24.	Sanford, Cushing & Co	56 90
Dec.	23.	M. B. Brown & Co	63 75
	23.	Sanford, Cushing & Co	15 00
	31.	W. C. Rogers & Co	103 35
	31.	Francis & Loutrel	110 50
	31.	R. M. Whiting, Jr	188 95
	31.	Sanford, Cushing & Co	3 50
	31.	John M. Burnet	20 75
	31.	M. B. Brown & Co	15 00
	31.	W. C. Rogers & Co	93 90
	31.	M. B. Brown & Co	51 25
1869.			
Mar.	2.	Francis & Loutrel	3 40
	2.	Sanford, Cushing & Co	11 75
	24.	D. Appleton & Co	50 93
	24.	M. B. Brown & Co	20 00
	24.	Sanford, Cushing & Co	144 65
	24.	Snyder, Black & Sturn	177 00
	24.	John W. Orr & Co	427 00
	24.	R. M. Whiting, Jr	241 90
	26.	Francis & Loutrel	86 50
	27.	M. B. Brown & Co	131 00
	29.	D. Appleton & Co	149 95
	29.	Sanford, Cushing & Co	14 00
	29.	Sanford, Cushing & Co	9 00
April	20.	Sanford, Cushing & Co	120 00
	20.	Dickie & Sampson	6 00
	20.	Francis & Loutrel	155 25
	20.	D. Appleton & Co	9 37
	26.	W. C. Rogers & Co	1,086 40
	26.	Dickie & Sampson	3 25
May	21.	Sanford, Cushing & Co	33 50
	21.	D. Appleton & Co	30 00
	21.	M. B. Brown & Co	20 00
	21.	R. M. Whiting, Jr	185 10
	29.	D. Appleton & Co	20 83
June	10.	Sanford, Cushing & Co	13 50
	10.	Francis & Loutrel	153 75
	10.	D. Appleton & Co	67 00
	17.	W. C. Rogers & Co	58 05
	17.	Bergen & Tripp	38 11
	17.	R. M. Whiting, Jr	89 70
	17.	Sanford, Cushing & Co	14 00
	17.	C. Van Benthuysen & Sons	4,154 26
July	2.	James L. Hastie	40 00
	9.	M. B. Brown & Co	40 00
	13.	D. Appleton & Co	6 17

July	13.	Dickie & Sampson	$43 95
Aug.	19.	Snyder, Black & Sturn	12 00
	19.	Sanford, Cushing & Co	119 95
	19.	Francis & Loutrel	75 00
	19.	R. M. Whiting, Jr	171 10
	19.	D. Appleton & Co	6 20
	19.	M. B. Brown & Co	69 00
	21.	M. B. Brown & Co	8 50
Sept.	2.	M. B. Brown & Co	18 00
	9.	Dickie & Sampson	15 00
	9.	D. Appleton & Co	16 22
	9.	M. B. Brown & Co	66 00
	29.	C. Van Benthuysen & Sons	15 00
	29.	Sanford, Cushing & Co	8 40
	29.	D. Appleton & Co	41 22
Oct.	4.	Sanford, Cushing & Co	3 00
	4.	W. C. Rogers & Co	198 00
	4.	D. Appleton & Co	80 61
	4.	Francis & Loutrel	120 63
	4.	Sanford, Cushing & Co	12 00
			$9,647 45

Advertising.

1868.			
Nov.	24.	New York Tribune	$180 00
Dec.	23.	Brooklyn Daily Union	21 00
	23.	New York Times	7 80
	23.	Evening Mail	7 20
	23.	The Sun	9 75
	23.	W. C. Bryant & Co.	6 30
	23.	The World Co	7 80
	23.	New Yorker Staats Zeitung	3 75
	23.	New York Tribune	28 50
1869.			
Feb.	23.	Brooklyn Daily Union	28 06
	23.	New York Times	46 80
	23.	New York Tribune	30 00
May	21.	New York Times	110 00
	21.	I. Van Anden	3 60
June	10.	Brooklyn Daily Union	62 20
July	13.	The Sun	3 50
	13.	New York Times	28 00
	13.	The World Co	3 20
Aug.	19.	New York Times	33 60
	19.	New York Tribune	136 50
Sept.	2.	New York Times	6 80
	29.	Brooklyn Daily Union	42 80
			$816 16

Contingent Expenses.

1868.			
Nov.	30.	Maria Lyons	$35 00
	30.	Mary Connolly	15 00
Dec.	23.	Maria Lyons	35 00
	23.	Mary Connolly	15 00
	23.	Manhattan Ice Co	25 83
1869.			
Jan.	30.	Maria Lyons	35 00
	30.	Mary Connolly	15 00
Feb.	26.	Maria Lyons	35 00
	26.	Mary Connolly	15 00
Mar.	31.	Mary Ann Baker	25 00
	31.	Sarah Kelly	10 00
	31.	Mary Connolly	15 00
	31.	Postage Stamps	50 00
April	20.	A. Demarest	5 00
	20.	Mary Ann Baker	25 00
	20.	Sarah Kelly	10 00
	20.	Mary Connolly	15 00
May	25.	Mary Ann Baker	25 00
	25.	Sarah Kelly	10 00
	25.	Mary Connolly	15 00
June	30.	Mary Ann Baker	25 00
	30.	Sarah Kelly	10 00
	30.	Mary Connolly	15 00
July	30.	Mary Ann Baker	35 00
	30.	Mary Connolly	15 00
Aug.	27.	Mary Ann Baker	35 00
	27.	Mary Connolly	15 00
Sept.	29.	Mary Ann Baker	35 00
	29.	Mary Connolly	15 00
	29.	Silas W. Pearsall	80 00
	29.	Valentine & Butler	16 00
Oct.	29.	Mary Ann Baker	35 00
	29.	Mary Connolly	15 00
			$776 83

Law Expenses.

1868.			
Dec.	31.	D. B. Eaton—Disbursements	$33 35
			$56,814 54

NEW YORK COUNTY.

Salaries.

Commissioners—		
John O. Stone, from October 1, 1868, to October 1, 1869	$2,500 00	
Stephen Smith, from October 1, 1868, to October 1, 1869	2,500 00	
Joseph S. Bosworth, from October 1, 1868, to October 1, 1869	500 00	
Benjamin F. Manierre, from October 1, 1868, to October 1, 1869	500 00	
Matthew T. Brennan, from October 1, 1868, to October 1, 1869	500 00	
Thomas C. Acton, from October 1, 1868, to April 29, 1869.	290 28	
Henry Smith, from May 1, to October 1, 1869	208 33	
		6,998 61
Assistant Sanitary Superintendent—		
From January 22, to November 1, 1869.		2,722 22
Clerk in Sanitary Police Office—		
From November 1, 1868, to September 1, 1869	$1,000 00	
From September 1, to November 1, 1869	250 00	
		1,250 00
Sanitary Inspectors—		
Pay roll for November, 1868	$1,550 00	
do December, 1868	1,550 00	
do January, 1869	1,314 44	
do February, 1869	1,050 00	
do March, 1869	1,050 00	
do April, 1869	1,050 00	
do May, 1869	1,050 00	
do June, 1869	1,050 00	
do July, 1869	1,050 00	
do August, 1869	1,050 00	
do September, 1869	900 00	
do October, 1869	750 00	
		13,414 44
Assistant Inspectors—		
Pay roll for December, 1868	$413 32	
do January, 1869	336 63	
do February, 1869	900 00	
do March, 1869	900 00	
do April, 1869	1,000 00	
do May, 1869	1,000 00	
do June, 1869	1,683 33	
do July, 1869	1,400 00	
do August, 1869	1,522 99	
do September, 1869	1,696 66	
do October, 1869	1,793 32	
		12,646 25
Bureau of Vital Statistics—		
Pay roll for November, 1868	$1,888 21	
do December, 1868	1,894 98	
do January, 1869	1,417 76	
do February, 1869	1,153 32	
do March, 1869	1,153 32	
do April, 1869	1,153 32	
do May, 1869	1,099 15	
do June, 1869	1,133 32	
do July, 1869	1,153 32	
do August, 1869	1,153 32	
do September, 1869	1,133 86	
do October, 1869	986 74	
		15,320 62
		$52,352 14

Contingent Expenses.

1868.			
Nov. 24.	D. B. Hasbrouck	$100 00	
Dec. 17.	S. C. Hawley	500 00	
23.	Edward O'Hara	8 18	
23.	John Brady	18 60	
26.	Keyser & Co	96 99	
26.	Postage Stamps	50 00	
26.	John Bowne	12 89	
26.	C. F. Chandler	166 33	
31.	John Bowne	6 13	
31.	John Brady	12 18	
31.	A. Demarest	5 00	
31.	C. Golderman, Jr	55 22	
1869.			
Feb. 23.	M. A. Woods	10 25	
Mar. 2.	Charles Sears	50 00	
26.	C. F. Chandler	75 00	
31.	John Bowne	8 04	
Apl. 20.	John Brady	15 65	
May 11.	D. B. Mellish	675 75	
29.	Mary J. Leonard	300 00	
29.	George W. Dilks	350 00	
29.	George W. Walling	350 00	
29.	Horace A. Bliss	100 00	
June 4.	John Brady	18 30	
July 13.	E. J. Salmon	48 07	
13.	Norris R. Norton	7 50	
13.	Walker & Stolley	452 99	
Aug. 16.	Robert C. Brown	342 75	
19.	Noel, Saurel, & Antoine	22 42	
19.	B. P. Woods	20 00	
19.	John Bowne	14 11	
19.	John Brady	17 72	
19.	Robert C. Brown	12 00	
			3,922 07

Office Furniture.

1868.			
Dec. 31.	Robert Paton	$52 00	
1869.			
Mar. 24.	J. H. Keyser & Co	29 71	
24.	Connecticut Clock Co.	50 00	
May 21.	Robert Paton	12 00	
June 8.	Walker & Stolley	203 28	
11.	J. S. Gerau & Co	158 75	
29.	J. S. Gerau & Co	55 00	
July 13.	Smith Brothers	25 50	
Aug. 19.	A. T. Stewart & Co	212 89	
21.	A. T. Stewart & Co.	213 84	
21.	J. Ziegler & Co	686 00	
31.	Walker & Stolley	587 00	
31.	Walker & Stolley	430 00	
Sept. 2.	J. Ziegler & Co.	434 00	
2.	W. & J. Sloane	166 03	
9.	John L. Patmor	40 00	
18.	A. T. Stewart & Co	18 00	
			3,374 00

Office Rent.

1869.		
Aug. 1.	Paid Treasurer of Metropolitan Police for quarter ending July 31	625 00
		$60,273 21

KINGS COUNTY.

Salaries.

Commissioners—		
James Crane, from Oct. 1, 1868, to Oct. 1, 1869	$2,500 00	
Geo. B. Lincoln, from Nov. 1, 1868, to Nov. 1, 1869	2,500 00	
		5,000
Assistant Sanitary Superintendent—		
J. T. Conkling, for Nov., 1868,	$291 66	
do do Dec., 1868,	291 66	
do from Jan. 1 to Jan. 18, 1869	175 00	
R. Cresson Stiles, from Jan. 21 to Nov. 1, 1869	2,731 94	
		3,490 26
Assistant Attorney—		
Wm. Coit, from June 30 to Aug. 26, 1868	$158 33	
Henry S. Bellows, from Aug. 27 to Dec. 1, 1868	263 88	
do do from Dec. 1, 1868, to Nov. 1, 1869	916 66	
		$1,338 87
Deputy Registrar of Vital Statistics—		
R. Cresson Stiles, from Nov. 1, 1868, to Jan. 20, 1869		533 33
Clerks to Assistant Sanitary Superintendent—		
Pay roll for November, 1868	$450 00	
do December, 1868	450 00	
do January, 1869	475 00	
do February, 1869	516 66	
do March, 1869	516 66	
do April, 1869	428 29	
do May, 1869	654 16	
do June, 1869	641 66	
do July, 1869	641 66	
do August, 1869	620 82	
do September, 1869	480 00	
do October, 1869	541 72	
		6,416 63
Sanitary Inspectors—		
5 Inspectors, from Nov. 1, 1868, to Nov. 1, 1869, at $1,800		9,000 00
Assistant Inspectors—		
Pay roll for December, 1868	$126 66	
do January, 1869	16 66	
do April, 1869	300 00	
do May, 1869	300 00	
do June, 1869	300 00	
do July, 1869	300 00	
do August, 1869	300 00	
do September, 1869	300 00	
do October, 1869	300 00	
		2,243 32
		28,022 41

Contingent Expenses.

1868.			
Nov. 16.	B. B. Baptist	$99 00	
24.	Horace Strang	18 00	
Dec. 31.	John Corr	5 00	
31.	Thomas Harold	1 10	
31.	J. S. Stryker	2 82	
31.	Woodruff & Robinsons	436 20	
31.	F. H. Penney	35 50	
1869.			
Feb. 18.	John Corr	6 48	
Mar. 29.	do	3 08	
May 21.	do	5 00	
June 4.	do	5 32	
17.	J. E. Smith & Son	67 00	
17.	Lakeman & Bros	3 50	
July 1.	B. B. Baptist	195 00	
1.	John Corr	6 10	
Aug. 19.	do	9 04	
19.	W. A. Pascal, Agent.	50 00	
19.	Postage Stamps	10 00	
19.	E. R. Squibb	39 60	
19.	B. B. Baptist	195 00	
19.	James R. Bird	16 00	
19.	J. S. Stryker	10 16	
Sept. 2.	John Corr	9 54	
2.	F. S. Lincoln	18 00	
2.	J. E. Smith & Son	100 25	
2.	B. B. Baptist	195 00	
29.	do	195 00	
Oct. 4.	E. R. Squibb	27 50	
			1,764 19
			$29,786 60

RICHMOND COUNTY.

Wm. O'Meagher, M. D., for services as Assistant Inspector, from May 12, 1868, to September 30, 1869	$553 30

Town of Newtown.

1869.		
Mar. 2.	John F. Hallett	$4 94
May 21.	New York Rendering Co.	10 00
Sept. 30.	George P. Wright, M. D., for services as Assistant Inspector, from Jan. 1, 1869, to Oct. 1, 1869	225 00
		$239 94

Town of Morrisania.

1868.		
Dec. 31.	N. K. Freeman, M. D., on account of services as Assistant Inspector	400 00
31.	Noah B. Hoyt, for execution of orders	831 67
		$1,231 67

Town of West Farms.

1868.		
Dec. 31.	N. K. Freeman, M. D., on account of services as Assistant Inspector	400 00

Town of Greenburg.

1869.		
June 30.	George Bayles, M. D., on account of services as Assistant Inspector	400 00

Town of Cortland.

1869.		
July 13.	Philander Stewart, M. D., on account of services as Assistant Inspector	300 00

Fund for Special Expenses in New York County.

(See Chapter [illegible] Laws of [illegible].)

1868.		
Nov. 21.	Dennis O'Connor	$11 00
21.	Joshua Dyson	[illegible]
21.	M. C. Rich & Son	[illegible]
21.	Pay roll—Disinfectant Dep't	[illegible]
Dec. [illegible]	John Mason	8 75
[illegible]	[illegible]	4 00
[illegible]	W. H. Wilson	[illegible]
[illegible]	Joshua Dyson	[illegible]
[illegible]	New York Gas Light Co	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible] and Brother	[illegible]
[illegible]	[illegible] & Co	[illegible]
[illegible]	[illegible] & Murphy	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible] & Murphy	[illegible]
[illegible]	[illegible]	[illegible]
1869.		
[illegible]	[illegible]	[illegible]
[illegible]	[illegible] & Burbank	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

21.	Warren Chemical and Manufacturing Co.	$62 26
21.	Wm. H. Wilson	7 25
21.	M. C. Rich	53 75
21.	Hallett, Seaver & Burbank	45 50
29.	New York Gas Light Co.	46 20
29.	Pay roll—Disinfectant Dep't	785 00
June 4.	George Tiemann & Co	30 00
10.	Hallett, Seaver & Burbank	39 21
10.	Joshua Dyson	73 06
10.	Owen Fallon	18 00
10.	David Porter	16 73
17.	W. N. Seymour & Co.	23 80
17.	Jones & Hubbell	10 00
23.	Pay rolls—Disinfectant Dep't	865 00
23.	E. Harris	15 12
23.	E. Harris	43 51
30.	Pay roll—Vaccinating Corps	6,083 33
July 23.	Pay roll—Disinfectant Dep't	868 82
Aug. 19.	David Porter	18 76
19.	D. Goggin & Son	9 50
19.	Joshua Dyson	49 85
21.	Hallett, Seaver & Burbank	48 72
27.	Pay roll—Disinfectant Dep't	598 32
Sept. 2.	Joshua Dyson	81 76
2.	J. L. & D. S. Ryker	86 20
2.	New York Gas Light Co.	24 15
2.	W. N. Seymour & Co.	6 00
24.	Pay roll—Disinfectant Dep't	846 50
24.	Eimer & Amend	9 25
24.	Hallett, Seaver & Burbank	16 50
24.	Walter & Baumgarten	57 00
24.	E. P. Clark	4 80
24.	Charles Richter	3 75
Oct. 22.	Pay roll—Disinfectant Dep't	663 50
22.	E. J. Darken	85 50
22.	J. P. Loines	996 50
22.	Central Dispensary	146 45
22.	Northern Dispensary	324 00
22.	John L. Keables	24 15
22.	Graves & Co	30 33
		$16,778 01

Fund for Execution of Orders in New York County.

1868		
Nov. 17	Paid contractor for execution of— Order No. 3,487	$262 40
17	do No. 3,877	89 36
17	do No. 4,487	8 00
17	do No. 3,617	84 01
17	do No. 4,353	16 00
17	do No. 170	260 00
17	do No. 3,391	148 85
17	do No. 4,595	94 25
17	do No. 156	124 25
20	do No. 3,440	6 00
20	do No. 3,601	145 34
20	do No. 3,255	6 00
20	do No. 3,370	30 45
20	do No. 3,890	62 22
20	do No. 91	334 33
20	do No. 3,942	9 00
20	do No. 3,934	45 [illegible]
20	do No. 100	372 33
20	do No. 4,094 and 4,018	69 11
20	do No. 3,604	55 [illegible]
20	do No. 3,800	107 76
20	do No. 111	133 13
20	do No. 80	3 00
20	do No. 140	[illegible]
20	do No. 118	[illegible]
[illegible]	do No. [illegible]	[illegible]
[illegible]	do No. [illegible]	[illegible]
[illegible]	do No. 191	[illegible]
[illegible]	do No. 103	[illegible]
[illegible]	do No. 191	[illegible]
[illegible]	do No. [illegible]	[illegible]
[illegible]	do No. [illegible]	[illegible]
[illegible]	do No. [illegible]	[illegible]
[illegible]	do No. 81	[illegible]
[illegible]	do No. [illegible]	[illegible]
[illegible]	do No. [illegible]	[illegible]
[illegible]	do No. [illegible]	[illegible]
[illegible]	do No. [illegible]	[illegible]
[illegible]	do No. [illegible]	[illegible]
[illegible]	do No. [illegible]	[illegible]

Nov. 20.	do	No. 14	$38 55
20.	do	No. 8,742	21 75
20.	do	No. 4,568	13 25
20.	do	No. 4,578	24 25
20.	do	No. 4,618	12 00
20.	do	No. 4,894	83 75
20.	do	No. 4,248 and 4,245	68 00
20.	do	No. 4,144	23 50
20.	do	No. 4,837	28 85
20.	do	No. 4,580	19 85
20.	do	No. 4,567	4 75
20.	do	No. 4,089	18 00
20.	do	No. 185	424 88
20.	do	No. 4,005	68 84
20.	do	No. 168	88 18
20.	do	No. 157	90 08
20.	do	No. 171	96 20
20.	do	No. 4,163	30 20
20.	do	No. 160	10 00
20.	do	No. 4,096	97 88
20.	do	No. 156	24 63
20.	do	No. 4,200	99 15
20.	do	No. 4,533	18 45
20.	do	No. 82	26 70
20.	do	No. 187	45 80
20.	do	No. 180 and 186	120 65
Dec. 22.	do	No. 4,414	3 00
22.	do	No. 4,418	3 00
22.	do	No. 531	8 23
22.	do	No. 34	840 92
22.	do	No. 4,205	71 18
22.	do	No. 189	16 00
22.	do	No. 4,510	5 50
22.	do	No. 4,800	22 29
22.	do	No. 4,389	8 00
1869.			
Sept. 9.	do	No. 8,835	123 26
			$5,871 98

Fines and Penalties—New York County.

1868.		
Nov. 24.	R. M. Lush, Marshal's fees ...	$247 80
Dec. 23.	do do ...	450 83
31.	do do ...	478 51
31.	Matthew Nugent, do ...	30 14
1869.		
April 20.	R. M. Lush, do ...	281 06
20.	George Bliss, Jr., Disbursements	1,200 00
June 4.	R. M. Lush, Marshal's fees ...	382 92
June 11.	George Bliss, Jr., Disbursements	$417 21
Aug. 19.	R. M. Lush, Marshal's fees ...	975 54
		$4,459 01

Fund for Cleaning Streets.

(Not included in Street-Cleaning Contract.)

1868.		
Dec. 4.	Robt. C. Brown, work in 12th Ward	$352 00
31.	do do	196 00
1869.		
Sept. 8.	Robt. C. Brown, work in 12th Ward	200 00
29.	do do	160 00
		$908 00

Fund for Drinking-Hydrants and Urinals.

1868.		
Dec. 23.	Robt. C. Brown, repairing Hydrants in 121st Street, 125th Street, and Union Square...	$43 60
23.	Robt. C. Brown, putting in Hydrant, corner of 116th St. and 4th Avenue	56 88
1869.		
June 17.	Robt. C. Brown, Urinal in Astor Place	2,500 03
Sept. 21.	D. D. Nash, 10 Combination Fountains	1,641 50
		$4,241 98

Temporary Loan Account.

1869.		
Mar. 31.	Paid National Shoe and Leather Bank amount borrowed March 23, 1868, for expenses in Newtown	$40 39
31.	Paid Eighth National Bank amount borrowed May 30, 1868, for expenses in Newtown	2 25
		$42 64
		$182,300 88

RECAPITULATION.

General Expenses—		
Salaries	$45,540 75	
Stationery and Printing	9,647 45	
Advertising	816 16	
Contingent expenses	776 83	
Law expenses	33 35	
		$56,814 54
New York County—		
Salaries	$52,352 14	
Contingent expenses	3,922 07	
Office furniture	3,374 00	
Office rent	625 00	
		60,273 21

Kings County—		
Salaries	$28,022 41	
Contingent expenses	1,764 19	
		$29,786 60
Richmond County		553 30
Town of Newtown		239 94
Town of Morrisania		1,231 67
Town of West Farms		400 00
Town of Greenburg		400 00
Town of Cortland		300 00
Special expenses in New York County		16,778 01
Execution of orders in New York County		5,871 98
Fines and penalties New York County		4,459 01
Cleaning streets in New York (not included in contract)		908 00
Drinking-hydrants and urinals		4,241 98
Temporary loan account		42 64
		$182,300 88

Balance on hand, Nov. 15, 1868, as per report	$91,306 22	
Total receipts from Nov. 15, 1868, to Nov. 1, 1869	164,017 24	
		$255,323 46
Total disbursements from Nov. 15, 1868, to Nov. 1, 1869	$182,300 88	
Balance on hand	73,022 58	
		$255,323 46

METROPOLITAN SANITARY DISTRICT, *ss.:*

Benjamin F. Manierre, being duly sworn, doth depose and say, that the accompanying Report contains a detailed statement of all moneys received and paid out by the Metropolitan Board of Health, and a "detailed statement of the manner of expending" of such money, from the fifteenth day of November, 1868, to the first day of November, 1869, and further saith not.

BENJAMIN F. MANIERRE, *Treasurer.*

Sworn before me this 23d day
of November, 1869.

JAMES A. COLVIN,
Notary Public, N. Y. County.

The undersigned Commissioners, Auditing Committee of the Board, have examined the foregoing accounts of the Treasurer, and found them to be correct.

GEORGE B. LINCOLN,
M. T. BRENNAN.

NEW YORK, *November* 30, 1869.

APPENDIX.

"A."

REPORT OF THE SANITARY SUPERINTENDENT.

OFFICE OF SANITARY SUPERINTENDENT,
December 31, 1869.

To the Secretary of the Metropolitan Board of Health:

SIR: I have the honor to submit the following report upon the duties performed by the various officers and employés of the Board of Health under my superintendence during the year ending December 31, 1869:

As in the three previous years, the most important part of the work performed in the executive department has consisted in skilled inspections by medical officers, and the pressure of the Board's orders, under repeated reinspections and advice, to secure faithful compliance with the health laws. The amount and the result of this class of duties are summed up and correctly stated in the respective sub-district reports, and in the yearly summary that I have already furnished for the information of the Board.

The consolidated abstract which is presented in the Board's general Report (page 9), shows that the Sanitary Inspectors in the Metropolitan District made reports upon 70,326 inspections during the twelve months ending November 1, 1869. The classified abstract here mentioned shows what subjects received the attention of medical officers generally, while the tabulated statements which follow in this report show what subjects received official attention in New York, Brooklyn, and the several sub-districts and the rural villages. As far as practicable, every department and branch of sanitary work will have its own records and results of work separately presented.

DISTRIBUTION OF SANITARY WORK.

Skilled and Unskilled Labors.—The work of the Board during the past year has been performed almost exclusively by educated physicians, the only unskilled labor being that which was employed in the special cleaning of streets and removal of nuisances. The experiment of employing searchers of nuisances brought into service, for a time, a certain number of non-medical men whose labors are to be classified as unskilled, but the practical usefulness of which was found to be generally in exact proportion to the educated and intelligent qualities of the class of men so employed. The chemist, the foreman of disinfection and analysis, and the sanitary engineer, justly take rank both in skill and results of labor with medical officers. Thoroughly scientific methods and trustworthy results have characterized their labors.

The Assistant-Sanitary Superintendents. — Assistant-Superintendent Dr. R. C. Stiles, in Brooklyn, and Assistant-Superintendent Dr. Moreau Morris, in

New York, have, respectively, performed with great success the duties defined by the Board's regulations, and as required by the Superintendent. As far as practicable, the affairs of the Brooklyn office have been so conducted as to give to the Assistant Superintendent in that city very large responsibility. The annual report of that officer is submitted herewith; and special reports by Assistant-Superintendent Morris are also submitted. Their several reports show the nature of some of their more important labors. Entire harmony has characterized their intercourse and service.

Sanitary Inspectors and Assistant Inspectors.—The roll of this class of officers, at the end of the year 1869, is as follows:

SANITARY INSPECTORS.

NAME.	Date of Appointment.	Sub-District.
New York.		
W. F. Deming, M. D.	April 12, 1866.	First.
C. F. Roberts, M. D.	July 1, 1868; Jan. 19, 1869	Third.
J. T. Nagle, M. D.	Jan. 23, 1869; Dec. 30, 1869.	Sixth.
W. H. B. Post, M. D.	July 2, 1868; Jan. 9, 1869	Seventh.
L. Damainville, M. D.	July 2, 1868; Jan. 19, 1869.	Tenth.
C. P. Russell, M. D.	Jan. 22, 1869; Dec. 30, 1869.	Eleventh.
E. H. Janes, M. D.	April 7, 1866	Twelfth.
A. Vielé, M. D.	Jan. 22, 1869; Dec. 30, 1869.	Fifteenth.
H. O. Ely, M. D.	May 4, 1869; Dec. 30, 1869.	Eighteenth.
A. B. Judson, M. D.	April 22, 1869; Dec. 30, 1869	Ships and waterside.
Brooklyn.		
J. R. Bird, M. D.	April 11, 1866.	
F. H. Cotton, M. D.	March 28, 1866.	
S. N. Fisk, M. D.	April 10, 1866.	
S. J. Holley, M. D.	June 2, 1866.	
W. H. Thayer, M. D.	August 27, 1866.	

ASSISTANT INSPECTORS.

New York.		
O. G. Smith, M. D.	May 29, 1869	Second.
G. B. Smith, M. D.	Jan. 22, 1869	Fourth.
F. J. Randall (deceased), M. D.	Jan. 22, 1869	Fifth.
C. F. W. Haase, M. D.	Sept. 2, 1869	Eighth.
N. S. Westcott, M. D.	Jan. 22, 1869	Ninth.
J. W. Robie, M. D.	May 29, 1869	Thirteenth.
R. Tauszky, M. D.	May 29, 1869	Fourteenth.
S. D. Wadsworth, M. D.	July 1, 1868; Jan. 23, 1869	Sixteenth.
J. B. Read, M. D.	May 29, 1869	Seventeenth.
W. T. Carpenter, M. D.	May 29, 1869.	
W. C. Roberts, M. D.	Sept. 2, 1869.	
James Ingram	May 29, 1869.	
Brooklyn.		
S. J. Brady, M. D.	March 30, 1869.	
C. Corey, M. D.	March 30, 1869.	
R. M. Wyckoff, M. D.	March 31, 1869.	

ASSISTANT INSPECTORS IN RURAL SUB-DISTRICTS.

N. K. Freeman, M. D.	April 18, 1866	West Farms & Morrisania.
G. P. Wright, M. D.	June 22, 1867	Newtown.
W. O'Meagher, M. D.	June 17, 1867	Edgewater, S. I.
Solomon Andrews, M. D.	July 30, 1869	Westfield.
P. Stewart, M. D.	July 1, 1867	Cortlandt.
G. Bayles, M. D.	July 27, 1867	Greenburg.
G. J. Fisher, M. D.	August 22, 1868	Ossining.

The District Medical Officers continue to be held to a strict accountability for the constant and faithful attention to the sanitary condition of their respective portions of the common field of labor, and their work has been methodically conducted in all respects. The immense task of making a complete sanitary survey of the tenement-houses, and of the sanitary topography of each sub-district, and the demand for ceaseless vigilance in the duty of controlling the multiplied sources of small-pox throughout the entire year, have rendered it necessary to impart the greatest practicable simplicity and responsibleness to the methods and duty of the sanitary service.

The Chemist and the Chemical Inquiries.—The reports by Prof. Chandler, chemist to the Board, are presented in Appendix "E." They may justly be regarded as models of illustrations of the practical value of chemical analysis and study in aid of public hygiene.

The Disinfecting Department.—As a first step in the reorganization of this branch of service, the Board authorized the selection of an accomplished chemist, M. Alsberg, Ph. D., as foreman in charge of the work, and, under the chemist, also in charge of the chemical rooms, apparatus, and ordinary chemical analyses. Hermann Endemann, Ph. D., succeeded Dr. Alsberg, and has conducted his duties with great success. Convenient and economically-furnished rooms for chemical analyses having been fitted up in the new building at 301 Mulberry Street, the duties pertaining to this branch of sanitary chemistry were soon brought into a condition of effective organization and practical usefulness that had been unattainable without the aid of the well-ordered laboratory for analyses and chemical testing. The Sanitary Superintendent refers, with peculiar satisfaction, to the several special reports by Prof. Chandler, the chemist to the Board, and by Dr. Endemann, the foreman, which are herewith submitted; for they instructively show how chemistry and the most exact kinds of physical knowledge are now applied in the duties pertaining to the public health.

The Sanitary Engineer's Department.—This department of sanitary service has daily contributed its skilled resources to give precision and practical adaptation of proposed methods of improvement to the ends sought. The extensive and thorough plans of deep drainage which have been projected, ordered, and to a great extent completed during the year, have, more than in any previous year, called into requisition the services of the Sanitary Engineer. His assistant, an experienced plumber and engineer in house-sewerage, etc., continued to be peculiarly useful as an Assistant Sanitary Inspector. Success in securing the execution of the Board's orders, as well as in adapting official complaints for the proper form of order, has been greatly enhanced by the labors of the Sanitary Engineer's department. The records of the executive and medical service of the Board the past year, show that the great majority of the official complaints by Sanitary Inspectors and assistants, have been followed by orders which resulted in faithful and usually cheerful execution and compliance.

Special and Temporary Kinds of Sanitary Inspection and other Labors.—The special inspection and compulsory measures ordered by the Board concerning the unauthorized dumping and exposure of manure and garbage in different parts of New York; the daily inspection of all fat boiling and rendering establishments; the sanitary cleaning and disinfection of streets at various times; the inspection of stables; and, especially, the systematic vaccination of the children and unvaccinated persons in New York, have been special and unusual labors that called into the service of the Board temporarily numerous skilled persons whose names are not (for space forbids) placed in this report. The labors of the temporary medical assistants whom the Board employed in house-to-house vaccination are mentioned in an appended statement on vaccination.

Statistical Summary of Inspections.—In the abstract given in the general report by the Board, the total number of sanitary inspections of separate places, buildings, and structures of various kinds, amounts to 70,326 in the twelve months ending November 1, 1869. The daily records of the sanitary service in the city of New York give the following:

Summary of Work for the Year ending December 31, 1869.

(By Medical Officers of the Metropolitan Board of Health in the City of New York.)

Tenement-houses	24,021
Private and other dwellings	10,961
Cellars and basements	3,880
Stores and warehouses	2,913
Factories and workshops	1,264
Public buildings	98
Markets and market-places	12
Other buildings	1,497
Fat rendering and melting establishments	327
Slaughter-houses and abattoirs	202
Gut-cleaning and glue-factories	23
Chemical works	1
Manure-vaults and stables	3,147
Manure-boats and dumping-grounds	24
Privies and water-closets	7,943
Gutters, cesspools, and other nuisances	5,052
Wharves and piers	165
Emigrant-ships	167
Other ships	63
Sailor boarding-houses	30
Vacant lots, streams, and public grounds	667

Schools and seminaries	95
Contagious diseases	466
Total	63,018
Vaccinations specially recorded	43,359

Sanitary Inspection in Towns.—Each of the medical officers in suburban villages of this district has endeavored carefully to study and survey the sanitary wants of his sub-district. The reports now submitted by them will be consulted with interest by citizens who desire to promote sanitary improvements in the rural districts—in villages where the city populations seek their homes in summer.

The limited compensation and the inadequate support in the local courts, granted by town authorities to these sanitary officers, have not discouraged them: their intelligent efforts have steadily contributed to the growth of a wholesome regard for sanitary law, and the kind of knowledge on which it is founded. The last reports of these officers show that the deep and thorough drainage of village sites and of malarial grounds is the very first work of sanitary improvement needed in the suburban towns. By the aid of the Sanitary Engineer of this Board, each of these Assistant Inspectors has prepared a diagram map to illustrate the facts relating to *sanitary drainage* in the respective sub-districts.

CONTAGIOUS AND INFECTIOUS DISEASES.

Typhus and Typhoid Fevers.—In January and February there occurred a series of outbreaks of each of these varieties of fever that justly gave anxiety to the medical officers. Starting from a filthy cellar, in which old rags and refuse bedding materials had long been stored and assorted under a tenement-house on East Thirteenth Street, a line of contagious progress was taken by the typhus fever that soon extended to several blocks of overcrowded tenement-houses. The timely transfer of the sick to the Fever Hospital, the thorough purification and disinfection of the tenements, their surroundings, and the introduction of the structural alterations to provide for ventilation as required by the Tenement-House Law, soon exterminated this threatening outbreak. The low cellars in that quarter of the city were at that time thoroughly inspected, and those of a dangerous character were peremptorily vacated and closed by order of the Board.

During the months of February and March there occurred a series of outbreaks of typhoid fever that were traceable to two centres, whence they spread by the movement of the sick, or of their attendants, who in turn became sick. These sources of fever were successfully controlled by sanitary means, the chief of which was abundant and repeated disinfection of all sinks, privies, premises, and local sewers, with heavy oil-of-coal tar and the sulphate and sesquichloride of iron. With these exceptions, the city and entire Metropolitan District have remained remarkably free from typhoid fever the past year. It is a malady greatly to be dreaded in a crowded tenement population, especially during periods of drought, such as was experienced from July until November last, when the grounds and sewers of the cities were but lightly and very seldom washed by rains.

Small-Pox.—The complete record of this loathsome disease, and an account of the work of vaccination during the year, will be found appended as a separate chapter at the close of this report. A contagion, the germs of which can be garnered in whatever foul stuffs may have received it from the persons of the sick, and so accumulated and increased from every quarter whence the movement of masses of people can convey it, may produce epidemic phenomena that would be almost inexplicable to the purely abstract reasoner concerning such events. But the course of this contagion can be so observed and anticipated as to enable the people of any community to insure their own timely protection, if they will, by vaccination. And in New York this effort was proposed in season, but the execution of the task was not begun in any adequate manner until the spring months. As this effort required, for its entire success, the thorough vaccination of more than 100,000 persons, it was a task for a year, and not for a single month. By a very great endeavor the Board's officers succeeded in vaccinating 30,000 in the month of June, and in the year ending December 31st, nearly 50,000 persons. This amount of defence could only be partial and unsatisfactory, but, with care in the duty of domestic quarantine of the sick and the disinfection or the burning of materials contaminated by small-pox, the fatality of the disease has been kept within limits, though its epidemic tendency has been strongly marked throughout the entire year. The practical value of vaccination and the utility of domestic quarantine, and of effectual disinfection, have been well tested, and the necessity of exact methods and expert skill in the application of these preventive agencies has been abundantly shown.

Yellow Fever.—The total number of ships reported to this department by the Health Officer, as having had cases of this disease on board during voyage, or at the port of departure, during the year, was five. Besides these, there have been forty-two other vessels reported by Health Officer as having arrived from ports in which yellow fever was prevailing at the time of the ship's departure. The restraints which are placed upon ships and goods from ports infected with yellow fever, under the requirements provided in Section 31 of the Code of Health Ordinances, were applied as leniently as could be justified: only five vessels, of the classes mentioned, were required to remain, even for a single day, at anchor and away from the docks, after receiving the Quarantine Officer's permit to depart from the limits of Quarantine anchorage off Staten Island; and only four of these ships were required to remain 300 yards off for a longer period than three days.* The Board of Health having, early in the spring, ordered that all immigrant ships, etc., should be inspected by one of its medical officers, a systematic waterside sanitary inspection was instituted, and by this means the movement and events relating to vessels from the West-Indian ports were readily kept under constant surveillance. This scourge may justly continue to be dreaded, though it seldom strikes. It does not respect sanitary regulations nor medical skill in such manner as to warrant any relaxation of the rule which excludes the infected ships from the docks in the commercial districts of New York and Brooklyn. Fortunately the sanitary art of protecting ships and cargoes against infection may yet be so practised as to give greatly increased, and perhaps perfect, security against this scourge of the American tropics.

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* The following summary shows precisely the nature and extent of all the official proceedings of the Board of Health and the Sanitary Superintendent in reference to any required detention, or restraint from coming to dock, by ships from Quarantine during the year 1869:

Number of vessels reported by Health Officer's certificate to the Metropolitan Board of Health from infected ports, 47; number of vessels in which cases of yellow fever were certified to have occurred on passage or in port, 5; number of vessels which were certified by Health Officer and required by the Board of Health to remain 300 yards away from shore, 5.

Nuisances against the Public Health.—Nuisances, directly detrimental to health and dangerous to life, are so numerous and so constantly liable to production and growth in a great city, that the officer of health finds himself compelled to give most of his time and official acts in endeavors to abate or prevent them. A vast number of the 63,018 sanitary inspections that were made by medical officers in New York, during the past twelve months, related to nuisances against health, or to conditions that were tending to create such nuisances. These nuisances may be classified as follows:

First.—The waste and refuse materials and the fats derived from the preparation of food articles for markets and for families. The rude and faulty method by which offal storage and transportation, and the rendering and melting of fats, are carried on in all great cities, results in producing very noticeable and offensive nuisances.

Second.—Offensive trades and manufactories, or trades offensively conducted, yet which need not be in themselves offensive nor injurious to the public health.

Third.—Filthy streets and the accumulation and neglect of excremental matters.

Offal and Fats.—All the refuse animal matters, and the fats derived from the slaughter and preparation of animal food for nearly two millions of people, come to be, in one way or another, subject to sanitary inspection and regulation in the city of New York. The methods by which the most offensive animal matters are removed from the city and utilized have, doubtless, been very greatly improved during the past three or four years; but they are still far from being in a satisfactory state; further improvement is needed. Moreover, the business of rendering animal offal having been concentrated at a single point on the windward side of the city, namely, at a dock at the foot of West 38th Street, North River, the evils which attend the transportation and rendering of offal have become exceedingly noticeable to a large and well-populated section of the city. The great improvements that were devised, and have been quite skilfully applied, by the persons who are the contracting parties under municipal authority for the daily removal and care of offal and dead animals, have but partially overcome and prevented the offensiveness of emanations from the offal materials that are consigned to the Rendering Company's establishment. Daily inspections by expert and faithful agents of the Board of Health have been maintained over the transportation and rendering of offal and fats. The chief effects of this kind of inspections have been to secure, first, a complete termination of all surreptitious bone-boiling and fat-rendering, and consequently to concentrate these kinds of business in a particular locality on the west side of the city.

Every great city suffers similar inconveniences and causes of nuisance from the business of bone-boiling and fat-rendering. The insular position of New York, and the proximity of densely-populated neighborhoods to centres of such nuisances, render it necessary to secure the application of the best possible means that chemistry and engineering can supply to guard against these sources of offence until the time shall come when all such materials shall be securely conveyed away from the city at least twice every day.

Tallow and Lard Melting.—This business, as well as the rendering of grease from offal, is conducted in steam-tight tanks, except in a very few of the lard-packing establishments. The chief evils connected with the business are the results of careless and slovenly management. The restrictions imposed by the new Health Ordinance relating to this subject are producing a wholesome effect even before the granting of individual permits under that ordinance. There are at the present time in the city of New York nearly two hundred establishments, in which the fresh fats of food-animals are boiled and prepared for market. And of these places only five or six are engaged in the business of tallow-melting. In upward of one hundred and fifty places lard is prepared for the food-market.

The following special report upon the present state of fat-boiling and tallow-melting, as respects sanitary regulations in the city of New York, has been prepared, at my request, by Assistant-Sanitary Superintendent Dr. Moreau Morris:

> *Fat-boiling* includes the various kinds of business in which the fatty tissues of all animals are resolved, either into tallow, lard, oils, or grease. These products are obtained from animal tissues by the application of heat. This is applied by several different methods. Dry heat, is by a furnace underneath the kettle or tank; steam heat, by surrounding the tank with a steam jacket and coil of pipe within, and also by applying steam directly to the mass.
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> The results of these different manipulations are the various products of fatty tissue; the kind depending upon the animal from which it is obtained:
>
> That from beef cattle and sheep, being tallow; that from hogs, lard or lard oil; from horses, horse grease, or lubricating oil; that from house and butchers' refuse, soap-grease.
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> In obtaining these products, offensive gases and vapors are eliminated, causing the business to be more or less offensive, and oftentimes detrimental to the public health.
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> The great desideratum sought for in conducting this business is to find the method or apparatus that will avoid or overcome all conditions which give offence.
>
> To discover and perfect the most desirable method for rendering, has been not only the anxious inquiry of every conscientious manufacturer, but also a positive requirement of the Board of Health, in its earnest endeavors to protect the health of the public.
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> This business, in all of its various branches and details, is very extensive, involving an immense outlay of capital, and employing a large number of operatives. The demands of commerce and manufactures require the business to be prosecuted. The value of the various products and the utilization of the residuum for fertilizers are almost beyond computation. These products are intimately associated with almost all the necessities of life; they form part of our food, afford us light, reduce friction, heal disease, cleanse our clothing and persons, enter into many departments of manufactures and industries, revivify the exhausted

soil, and return to us in combination with other life-sustaining elements. Chemistry is but just developing the value of these and kindred substances, which have been heretofore lost or wasted, as to any directly reproductive value.

In the efforts of the Board to suppress the offensive conditions connected with this important business, it has, therefore, always sought to suggest and assist those engaged in it, in their honest endeavors to control the escape of such vapors or odors as were just subjects of public complaint.

Therefore, soon after the Board was organized, in the year 1866, as the complaints of citizens became frequent and persistent, the President, Mr. J. S. Schultz, directed a special investigation and report upon the "nuisance from fat-melting, with suggestions as to the remedies to be applied to overcome it." That report was made, after the business had been thoroughly studied, as to all the methods then employed. Suggestions were embodied in the report, by which improvements could be adopted which would enable the business to be continued without creating a public nuisance. The report was accepted by the Board, and forms an appendix in its Annual Report for 1866. The suggestions contained in that report the Board has sought to apply in all its requirements concerning the business since that time; and, whenever they have been rigidly complied with, the nuisance from escaping gases and vapors has been abated. During the year 1867 very few complaints were made to the Board of this nuisance. The business, generally, was well conducted. The majority of those engaged in it had supplied themselves with new apparatus, and, although some of these were imperfect in their construction, yet a very great improvement had been effected.

Under the regulation of the Board, the rendering business is now almost universally conducted by two principal methods in controlling the escape of offensive odors, viz., by combustion and condensation of the vapors and gases that are evolved during melting. These as yet have not fully and completely removed all causes of complaint.

They do effectually destroy or control all offensive odors coming from the steam-tight tanks, but there are other necessary concomitants of the business, in its details, which produce conditions quite as offensive and noxious, although not diffusible to so great a distance, as the more vaporized elements.

These are the accumulation of large quantities of crude fatty tissues, rapidly undergoing decomposition, in various and dispersed localities, awaiting transportation to the rendering-vats, and the disposition of the residuum, technically called "scrap" or "greaves."

During some stages of the operations also offensive odors are allowed to escape by carelessness. The condition of the scrap or residuum, by some of the methods, is that of semi-fluidity, so that it cannot be pressed into cakes as it can in other methods, and its condition as a consequence is therefore quite objectionable, as it rapidly undergoes decomposition.

In order to render the fatty tissues of animals into the various products in a manner unobjectionable to the public, it becomes necessary, not only that it shall be done in steam-tight tanks with combustion or condensation of the gases and vapors, but also that it shall be done quickly after the animal is slaughtered, and before decomposition shall have taken place. In order to do this effectually and profitably, the business of rendering should be done upon the same premises where the animal is slaughtered, thereby avoiding both delay and transportation through the city. By far the greater part of the evil and offensiveness of the business is at the present time due to the accumulation of crude fatty tissues at the rendering-houses. Exposure to the atmosphere for a short period, especially during the warm months, of the crude material, is accompanied with rapid decomposition, and the evolution of most nauseous effluvia. Hence the necessity for combining the business of slaughtering and rendering upon one and the same premises. But the powers of the Board are not of a nature to compel this much-desired improvement—concentration and capital only can succeed in accomplishing this result. In its efforts to suppress and control this much-complained-of evil, the Board has endeavored, by its regulations and ordinances, to carry out this policy; but diversity of interests has as yet prevented its consummation. Until very recently, the Board had not required the business of rendering lard exclusively to be done in steam-tight tanks or boilers, but advance in the knowledge of sanitary causes and effects which has been steadily growing in the public mind, and the consciousness that in the Board of Health the people have a just conservator of health, with power, have caused complaints of these establishments to be made. Silent tolerance of these air-polluting establishments can no longer be endured. Consequently, by a recent decree of the Board, all those who in any manner produce these evils have been obliged to ask for permits of the Board, which, in granting them, insists upon the business being conducted in the most unobjectionable manner, and with the best appliances yet discovered.

Comparing the present methods and results with those in use before the organization of the present Board of Health, no one can avoid according it the greatest praise for what has been accomplished, and, by pursuing a wise policy, this city may yet be rid entirely of this objectionable business.

Other cities, still suffering from the rude manner of conducting this business, are endeavoring to profit by our example, and, wherever Boards of Health are in existence, the same measures are gradually being adopted. The adoption of these improvements not only suppresses the nuisance, but has proved a pecuniary success; for a much larger percentage of yield is obtained, as well as a better quality of material, and consequently an advance in price. In this way the manufacturers become personally interested in adopting the required sanitary improvements.

Respectfully submitted,
MOREAU MORRIS, Assistant-Sanitary Superintendent.

NEW YORK, *December* 20, 1869.

Offensive Trades.—During the past year the Board of Health has continued its inquiries into the causes and effects of the nuisances attending the manufacture of illuminating gas. The information that is embodied in relation to this subject in the testimony taken before the Board is now presented entire in another Appendix; and that testimony may justly be considered as the most complete statement that has hitherto been made upon the nuisance here mentioned. Thus far, in the inquiry and the resulting controversy which the Board has had on this subject, no mention has been made of the unhealthful effect of gas-wastage in contaminating the atmosphere: the simple question has been how to reduce to the lowest possible degree, or how wholly to prevent, the emanation of poisonous and offensive gases from the gas-factories in respect of their processes of "purification." The fact, that from five to eight per cent. of all the illuminating gas manufactured escapes by leakage into the atmosphere, without being burned, presents an additional sanitary question which is of no small importance connected with this subject. Fortunately, self-interest tends to encourage the gas-manufacturers to adopt all practicable measures to prevent the nuisances that have, under the old methods of purification, been justly complained of as detrimental to the public health. Though the desired improvements come slowly, they are now sure to be adopted. The evidence that has, by the Board's action, been brought into definite propositions and statements for practical uses, cannot be set aside. The directors and stockholders, as well as the public at large, must now view al this evidence from this stand-point, as parties that really have mutual interest in the adoption of improvements which shall in the greatest possible degree prevent the contamination of the city atmosphere by poisonous and offensive gases.*

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* There now remains a very necessary improvement to be secured by the consumers of illuminating gas, in respect of less wasteful and more complete combustion and utilization in dwellings and places of public assemblage. Not only does a single gas-burner, in action, of the more common kind.

Chemical Factories.—The manufacturers of the various preparations of ammoniacal compounds, from the "ammonia-water" of gas-houses, have been repeatedly complained against by citizens. Their efforts to overcome all sources of nuisance in the management of their factories have been only partly successful.

Artificial Guano, Bone-Burning, etc.—The factories that were carrying on this kind of work at the beginning of the year persistently gave rise to well-founded complaints by sanitary inspectors and by citizens, until all of these establishments were finally removed far beyond the limits of both cities. Factories of this kind, that are at present in operation within the rural portions of the Metropolitan District, so employ certain cheap coal-tar disinfectants that the places are no longer complained of by citizens. In securing these reforms, we have uniformly offered, on behalf of this Board, the gratuitous and skilled instructions and inspections by the chemist, or by the foreman of the disinfecting department; and, by this means, improvements have been attained which official orders alone would not have brought about. Yet, in most instances, the Board's orders against these sources of nuisance have been a very essential part of the proceedings which ultimately secured the required improvements.

Various trades and industries that are necessarily attended with the production of dust, smoke, or offensive odors, have been the subject of complaining and of appeals in many ways—and in most cases the Board has successfully interposed in such manner as to give some relief, and procure important improvement; but, in the absence of definite statutes providing for the prevention of nuisances of smoke and offensive and irritating dust and gases, the remedies and improvements which the Board succeeds in applying must be more or less defective, both in degree and kind. The kinds of trades and manufactures in which phosphorus, sulphur, crude petroleum, arsenical preparations, compounds of ammonia, and lead, copper, mercury, and other poisonous elements or compounds are employed and manipulated, must ere long be so regulated by sanitary laws, that neither the people outside the factories, nor the operators in such trades, shall suffer needless injury by the emanations or waste particles of poisonous materials that are being wrought.

Already in the great cities we find associated with particular trades a well-defined but almost infinitely-varied group of *industrial diseases.* Lead-poisoning, which is frequently mentioned as an example of one of these maladies of industrial trades, is not more disabling and fatal in its operation than are the many other kinds of poisoning and injury which certain classes of artisans

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consume as much oxygen as an adult person in respiration, hour by hour, but there are various pernicious resultants, in the form of noxious gases and vapor, from a wasteful method of gas-lighting. The evidence concerning this matter is set forth in several examples by Dr. R. C. Stiles, Assistant-Sanitary Superintendent, in a report, that will be found in Appendix E in this volume. Dr. Stiles shows that a quantity of the air, which he caused to be taken in the Bowery Theatre, when all its gas-lights were in full blaze, on several occasions, contained seven parts of carbonic acid in 1,000 parts of the air. This is fifteen times the proportion that is found in the pure external atmosphere. He found the same excessive quantity of carbonic acid, besides other noxious gases, at the Olympic Theatre, and other places where dazzling gas-lighting is most excessive. The exceedingly accurate and ingenious tests applied by Dr. Stiles show that this subject is well worthy the sanitary inquiry he has given concerning it; and it is now desirable that the needless causes of gas-wastage, both in leakage and in wasteful burning, should receive sanitary care, and the means for preventing it, by the people whose interests and health are now injured by these evils.

and laborers are, in their occupations, compelled to suffer. It is highly desirable that this subject should receive such attention as shall secure the sanitary safety of all classes of dependent laborers in workshops, factories, printing-houses, etc. It has been justly said by a statesman, in matters of sanitary legislation concerning work-people, that it is "their right that, whatever work their employer assembles them to do shall, so far as depends upon him, be, at his cost, divested of all needlessly unwholesome circumstances."

Filthy Streets.—The streets of New York and Brooklyn have remained in a very unsatisfactory sanitary condition in respect of cleanliness the past year. Had any means and authority been found within the reach of the Sanitary Superintendent to clean or enforce the cleaning of the public streets of New York, under the Board of Health, no effort would have been spared to secure the cleansing. The independence of the contracting parties for street-cleaning, as regards the Board and its officers, and, worst of all, the absolute insufficiency of the specifications and sanctions of the contract itself, as a basis for procuring and enforcing the kind and amount of cleaning which is necessary for the sanitary welfare of the people, would make any criticism or suggestion upon the existing defects in civic cleanliness useless. Inasmuch as the contract which the city has made for cleaning provides for the execution of the work only once in each week throughout the tenement-house districts, those districts are, and will be, uncleanly. A tenement population that is crowded into single apartments, superimposed upon each other five, six, and even seven stories in height, destitute of dust-bins and garbage-vessels, and without adequate sinks and waste-drains to receive the domestic waste-water and slops, will, unless guarded unceasingly by a police-patrol, cast garbage and refuse materials into the streets and gutters.

The daily cleaning of all such overcrowded streets is a sanitary necessity; and, whenever the inhabitants of such streets find such cleansing enforced by public authority, they may then be induced to adopt the requisite means for preventing the filthy habit of throwing slops and garbage into the streets and gutters.

That it is possible to induce even the poorest and most ignorant of tenement populations to desist from defiling the streets was proved last summer by results that attended the daily efforts made by the two foremen of a small gang of street and gutter cleaners employed by order of the Board of Health. These two men, with the aid of one of the nuisance-searchers, in their earnest way, successfully addressed themselves to the task of dissuading the inhabitants from casting their domestic refuse and garbage upon the streets and gutters that were being cleaned for sanitary purposes by the Board of Health. Though the influence of such instruction to tenants, and of the printed order which these men gave to them did not last long after the Board's cleaning-gangs were withdrawn from the streets at the end of September, the fact here mentioned is important as showing that it is practicable to make the acts and management of civic cleaning the means of enforcing habits of cleanliness as respects the streets and gutters in the tenement-house districts.

The sanitary care of garbage [illegible] generally, or in any adequate manner provided for until [illegible] essential conditions for ensuring thoroughness and [illegible] of alleys and streets can be brought to bear; and these conditions are: 1. That garbage and slops (swill) shall be stored in separate and suitable vessels distinct from the vessels for ashes; and 2. That the daily removal of all domestic garbage, swill, and ashes, shall be performed with invariable regularity and thoroughness. It is idle to censure and upbraid the contracting parties or the inhabitants for the evils which the contract and plan together not only fail to provide against but actually foster into grossest nuisances.

In executing the work of street and gutter cleansing, which the Board ordered during the warm season, the average weekly expenditure amounted to only $300 per week, including the cost of disinfectants employed. As the Sanitary Superintendent could not exceed the instructions which restricted him to the merely sanitary cleansing, with permission to cause the dirt to be carted away only from a limited number of specified streets, he endeavored to extend the sanitary kind of cleaning, the flushing of gutters, and the application of disinfectants, to as many of the populous and unclean streets as possible.

Privy Scavenging and Disinfection.—This work was effectually reorganized last spring, and the methods of disinfection were reduced to a system that has proved at once efficient and economical. The experiments of the chemist and the foreman of disinfection, last winter, proved that to disinfect a load of ordinary night-soil, equal in bulk to a cubic yard, a little less than two pounds of liquid sesquichloride of iron, full strength, combined with *ten per centum* of its own weight of crude carbolic acid (Dr. Squibb's, 70 *per cent.*), would, in all instances, serve the purpose effectually. The scavengers cheerfully undertook to make their work as required; their apparatus was inspected and put in good condition, and the business was placed upon a basis of strict accountability.

The disinfection of all cloacal nuisances, particularly of the unsewered privies, and all old sinks and cesspools, is so much a domestic duty, that we have thought proper to encourage it by keeping up the distribution of the officia memorandum of instructions and advice concerning disinfection.

Manure.—The sanitary care and utilization of excremental matters, and of even the coarser stable-products, mark the regard for the public health as well as the good sense of a community; and, in an insular city like New York, it will be found to require efficient methods of business organization, to secure the perfect execution of sanitary scavenging.

It is estimated that not less than 1,000,000 cart-loads of stable-manure are removed from the city and island of New York in the course of a year; yet the entire business remains utterly unorganized, and the transportation is conducted wholly upon the principle of supply and demand, no organized capital nor methodical plans having been adopted by farmers and dealers for the proper removal and storage of the vast accumulations of stable-products. Hence the sanitary officers desire that farmers, and the dealers who supply them, should so organize the business of stable-scavenging and removal of manure as to free the cities from the nuisance of accumulations which no legal prosecutions and official orders can wholly prevent. The daily inspection that has been kept up at dumping-grounds and wharves by nuisance-searchers has served to diminish and prevent the former extent and offensiveness of this class of nuisances.

The Present State of Abattoirs and Slaughtering.—Upon this subject I have requested Assistant-Sanitary Superintendent Dr. Morris to make a special report, which is here presented. The attention which Dr. Morris has given to the sanitary condition of animals used for food adds value to his report upon this subject.

To E. Harris, M. D., *Sanitary Superintendent.*

Sir: By your direction, I have the honor to present the following report upon "the present condition, number, and sanitary relations and wants of the abattoirs and slaughter-houses in New York, with a concise record of past efforts for reform and comparison between past and present conditions."

For many years, as the population of this city rapidly increased, the question of the removal of slaughter-houses beyond its crowded precincts was from time to time agitated by the people.

The city government was importuned, the former City Inspectors entreated, and during the convocation of Boards of Health, under the old *régime*, this important matter affecting the public health was repeatedly under discussion. The business was recognized as being detrimental to the public health, yet so strong were the efforts of those interested in it, and so great was the want of unanimity among the nominal sanitary officials, that no authoritative or concerted action was brought to bear upon the question of its unhealthfulness.

Soon after the organization of the Metropolitan Board of Health, its officers discovered that slaughter-houses were the *nidus* of many deleterious conditions affecting the general health of the surrounding population. Located as they were, generally, in densely populated districts, where other unhealthy conditions added factors to the pestilential elements emanating from decomposing animal tissues, they became doubly dangerous to the public health.

With remarkable unanimity, the reports of the Sanitary Inspectors declared these places almost universally to be dangerous to the public health, and the Board was compelled to take decided action for the suppression or removal of the business from populous localities. In doing this, the Board sought to induce those engaged in it to combine and conduct the business upon the most approved abattoir plans. By these means, the business would not only be concentrated at favorable points, but could afford the needed facilities for controlling, rapidly removing, and utilizing all those offensive products which give rise to unhealthy conditions.

After considerable delay caused by legal interference, the Board finally established its rights through all the courts, and issued its orders, closing up all slaughtering-establishments below the line of 40th Street, after the 1st of January, 1869. Since that time, no slaughtering of animals for food has been permitted below that point. In its jealous care for the public health, it has steadily refused to grant permits to locate such establishments at points other than those near the river-banks, and upon the most approved plans. As a result, the present condition of the slaughtering-establishments compares very favorably with that of former years.

Much greater care in cleanliness, disposition of offal, and other concomitants, is now exercised.

Yet far greater improvements can and should be enforced. With one exception, these places are not conducted with that attention to details that would secure the best sanitary results.

The principal defects are in the want of a proper and authoritative supervision. As now conducted, each establishment is sub-let to various parties who are irresponsible individually to the general good, and, as a consequence, each conducts his own business in his own way, thereby often creating confusion, and invariably preventing that uniformity and unanimity with regard to cleanliness and freedom from offensive conditions with which a well-regulated abattoir should be maintained. Again, the ultimate utilization of all the various concomitants pertaining to the business is distributed to entirely too many remote points. The whole business should be conducted and completed under one general supervision, and within a circumscribed area. Slaughtering, rendering, utilizing the products either into clarifiers, fertilizers, or other uses that may be discovered and applied by science, should be concentrated.

An illustration of the methods and advantages of this combination is favorably shown, in a good degree, in the methods adopted by the Butchers' Hide and Melting Association. From the reception of the live animal to its final disposition, either as food or tallow, the whole business is conducted with scrupulous regard to cleanliness and healthy food, combined with the utilization of nearly all other products. The result is a well-ordered business, which not only proves that it can be conducted upon strictly sanitary principles, but yet be a financial success. At the date of the organization of the Board in 1866, there were over 200 slaughter-houses distributed throughout the city. At the present time there are but 50, and these are all located above 40th Street, and, by a recent resolution of the Board, no more permits will be granted for locating between 1st and 11th Avenues, thus confining them to the river sides.

One of the greatest and most troublesome evils, connected with slaughtering as formerly conducted, has been almost entirely abated, viz., that of driving cattle through the crowded thoroughfares of the city. No cattle are now driven below 40th Street, and those necessarily driven to the present slaughter-houses are now driven in the night or during the hours when scarcely any one is incommoded thereby. In accomplishing this result, the Board deserves well of the community. Still further improvement might be made in this respect, by having all live-stock, brought within the city limits, transported by barges or boats directly to the slaughter-houses upon either side of the city. But the time is not far distant when the interests of the butchers will not only compel this, but other improvements in their business which have been before indicated.

Respectfully submitted,

MOREAU MORRIS, *Assistant-Sanitary Superintendent.*

Markets.—Private enterprise, and the movement of the city population northward, as commerce and its warehouses yearly encroach upon the older quarters of the city, already begin to relieve the question of market reforms from the difficulties that have prevented sanitary improvement in their management.

As soon as the injunctions against sanitary interference at Washington Market had ceased by limitation, last August, a sanitary inspection of all that pertains to that ancient centre of market business was made, and the Sanitary Superintendent's report thereon was rendered, reiterating the declarations which had been made in 1866 against its grievous nuisances against health. A special inquiry was also instituted to ascertain the facts respecting the transportation, storage, deterioration, and distribution of food articles; also the amount and necessities of the trade in food supplies, so far as the facts relate to sanitary questions and market improvements connected therewith. The information obtained is of an important character, and it clearly enough proves that there is an urgent sanitary necessity for such improvements as will measurably separate the great wholesale commerce in food supplies from the family markets or stands, and at the same time give such commercial facilities as will secure a greater degree of freshness and soundness of food articles, of the perishable kinds, and especially that shall prevent the present unsanitary method of storage and handling of the gross supplies, for it appears that the deterioration of food while in market storage has already become a very serious matter of loss as well as of fraud; and, to the public health, it is a source of danger and injury.

The magnitude of a department of business that supplies the gross food articles for nearly two millions of people must not be underestimated, nor its own self-interests be misapprehended, in the effort to procure a reasonable sanitary arrangement for the city marketing. The transactions in Washington and Fulton Markets alone, according to the voluntary returns of the dealers themselves to revenue officers, amount to $44,030,750 yearly. And it is ascertained that the enormous losses which are suffered by deterioration and needless injury to some of the food supplies are so great that even the dealers themselves are almost forced to seek the speedy abatement or complete reconstruction of the existing markets in Washington, West, and Fulton Streets.

Deep Drainage.—The sanitary drainage of all those portions of New York and Brooklyn which are soon to be built upon, and great improvement and deepening of the drainage of various streets that pass through wet grounds, or that occupy parts of old water-courses, have received special attention by the sanitary officers of the Board the past year. In the reports of Sanitory Inspectors Vielé, Wadsworth, and Hudson, in this volume, the sanitary questions relating to this subject are well stated; and in the report of Mr. Worthen, Sanitary Engineer, this subject is further illustrated.

The several medical officers of this Board, in rural villages, have specially endeavored to awaken an intelligent public interest in deep drainage for sanitary and economical purposes. The Sanitary Superintendent has regarded it as a duty to encourage and direct this class of efforts throughout the district, and he would ask that special attention be given to the facts set forth in the annexed reports from the several officers.

TENEMENT-HOUSES.

Early in the spring a sanitary survey of the tenement-houses in New York and Brooklyn was commenced, with the design of bringing every dwelling and tenement, which is defined in the statute as a "tenement-house," under exact and systematic inspection and official registration. The design of this inspection comprehended also an effort to bring as large a portion as practicable of these dwellings into a reasonable conformity to the Tenement-house Law, while a record should be made in regard to all the essential points of conformity and non-conformity with the requirements of the law.

No sooner did the official returns of sanitary inspectors on this survey begin to come in for our examination, than two most important facts became obvious in regard to the practical necessity and benefits of this systematic inspection: first, it was in this way ascertained that a great number of the most unhealthful and neglected tenements had never before been brought under official observation or complaints, and that not a few of the occupants were too ignorant, timid, or indifferent, to become complainants against these worst of tenements; and, second, that there existed such remarkable and excessive conditions of overcrowding and sanitary insecurity in particular instances as to demand the most incisive official complaints in regard to violations of the Tenement-house Law, and also in regard to special nuisances, the habitation of dark and foul cellars, etc.

The rapid and threatening increase of small-pox in New York soon compelled the Sanitary Superintendent to throw the entire energies and time of the medical officers against that disease, and it was not until the middle of

July that this systematic survey of the tenement-houses could be resumed. At that date about one-third of the survey had been completed. The work was steadily pressed forward, but so interrupted and embarrassed by the current duties incident to reinspections on orders in progress of execution, etc., and by the pressure of small-pox in some of the sub-districts, that the rough notes of the survey have, with some difficulty, been completed within the present year. Whatever has been completed in the final summation and analysis of this immense work will be found in subsequent pages of this report.

Tenement-House Districts.—The overcrowding of habitations and the aggregation of such dwellings are evils of magnitude in themselves alone; but, added to these is the evil that results from unhealthfulness of locality. The densest of all our tenement-house population is found in those localities where defects in the grade and drainage of streets, and the uncleanliness and dampness of the surroundings, are ever contributing to the unhealthfulness of the tenement inhabitants. There are many limited exceptions to this general fact, and these exceptions serve to prove how much practical advantage there is in having our densely-crowded tenements favored by external conditions of salubrity.

Excessive Density of Population.—The tenement-house survey has revealed a rate of crowding in tenement-dwellings that has probably not been equalled in any other great city in the world. The absence of all law and restraint, in reference to the covering of city lots and crowding entire squares with tenement structures, until very recently seemed to have no limits, except the means of the owner, to add loft to loft and to cover the area as completely as possible with such buildings. There are numerous examples of tenement-houses in which are lodged several hundred people that have a *pro rata* allotment of ground area scarcely equal to two square yards upon the city lot, court-yard and all included. Instances of this kind will be given upon a subsequent page. Such overcrowding is attended by an excessive death-rate, and a train of physical and social evils that may justly concern every citizen.

It must be borne in mind that the classes of people that are crowded into the most densely-populated houses and blocks are, with rare exceptions, so poor and ignorant, or so uncleanly in their habits, that they would breed filth and sickness even in a prairie-cabin, unless kept under some kind of sanitary inspection. Hence the necessity for securing, in this class of tenement-houses, all the sun-lighting and ventilation possible. The provisions and requirements of the Tenement-house Act are producing beneficent results in all portions of the city where there are tenement-houses of the older kind, while it is securing the construction of new tenements of a good class. But the best tenements, if occupied by families that suffer pecuniary want, are very liable to be overcrowded, for, such is the lack of house-room in the city, that any kind of tenement can be immediately crowded with lodgers, if there is space offered; and hence it is that an excessive and unprecedented degree of overcrowding now exists among the poorest classes; hence it is also that the sanitary officers have found it necessary to proceed very gradually in the duty of requiring that cellar-tenements be ordered to be vacated.

Cellar Lodging-houses.—At the beginning of the year there were about three hundred cellars and basements used as common lodging-houses. These were mostly in the water-side district south of Grand Street. Being devoted to the lowest class of homeless wayfarers, and a very promiscuous and dangerous class of persons who become the ready carriers of diseases as well as frequent sufferers therefrom, the Sanitary Inspectors began, early in the spring, to complain of certain of the worst of this class of tenements as being unfit for habitation. After personally reviewing the complaints and evidence, the Sanitary Superintendent indorses his recommendation for permanent vacation and closure of the cellars that, in his judgment, endanger the public health as well as the life and health of the occupants. This kind of official duty has been plain.

The Board's timely action upon these recommendations has resulted in closing more than half of all the cellar lodging-houses in the city, or in bringing above ground several hundred families. There is no reason why this reform should not be steadily pushed forward until every cellar lodging-house shall have been closed, and every cellar tenement, which fails to comply reasonably with the requirements of the tenement-house law, shall have been vacated. It is mainly a question of time and prudence, for, in order permanently to benefit the poor and ignorant people who filled the cellars which have thus been brought under the Board's orders for vacating and cleansing, it has been deemed a duty to make the occupants understand that they would not be allowed to occupy such tenements. In carrying out this object, a judicious cellar-visitor has been kept employed since March last. No serious opposition has yet been experienced in this work, though a few lessees and speculators in low brothel lodging-houses have defied the Board. The largest and most dangerous of the cellar lodging-houses in the city have been permanently evacuated and closed as habitations. Nearly all of them were connected with tenement-houses, and against some of them proceedings were taken under the Tenement-house Act, but the evacuations are best secured under peremptory orders by the Board, on special complaint. Nearly three thousand wretched occupants of cellar lodging-houses and underground tenements have thus been brought into more healthful dwellings above ground.

Sickness and Mortality in Particular Houses.—In the Annual Report of Vital Statistics, which I have had the honor this year to submit to the Board of Health,* will be found a special report, by Mr. Norris R. Norton, Chief Clerk in the Sanitary Superintendent's department, on tenement-house mortality; and in that report the fact appears this year as in the records of the previous year, that an excessive death-rate has prevailed in particular houses, in particular blocks or rows of tenements, and in certain streets and certain portions of streets which are especially characterized by the structural and local conditions of insalubrity, that have been mentioned in the preceding paragraphs; instances are also given in that report which specially illustrate the fearful effects of overcrowding, and the attendant accumulation of physicial and social evils, in certain piles of tenements. I beg leave to refer to the report here mentioned as an embodiment of facts which should be studied in connection with the questions of tenement-house improvements that have been presented in preceding pages of this volume.

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* See Appendix "C."

The following examples of overcrowded tenement-houses that have been constantly described by the Sanitary Inspectors as being remarkable for the amount of sickness found in them at the times of their official visitations, and whose tenants have, in successive years, been found suffering an excessive death-rate, are mentioned in this place in evidence of the necessity that exists for still greater and more far-reaching sanitary improvements than can be secured under the Tenement-house Law alone. It will be borne in mind that neither the Tenement-house Act of 1867, nor the Health Ordinances of the Board, have yet defined the means by which the chief causes that produce such excessive unhealthfulness and mortality shall be prevented; indeed, some of these causes relate to social conditions and physical wants, and to consequences of vice, which can be restrained and mitigated only by comprehensive measures regarding both the sanitary and social necessities of the poorer classes.

The Tenements at 79 *Baxter Street.*—The Sanitary Inspectors' survey shows twenty-five families, comprising 112 persons, living upon the premises. The tenements are piled five stories high, and the rear is built back to back, against another pile of rear tenements upon Mulberry Street lots, and which are entered from that street. In this population of 112 persons, six died in their tenements of various diseases, a death-rate equal to 53 6-10 in 1,000, yearly.

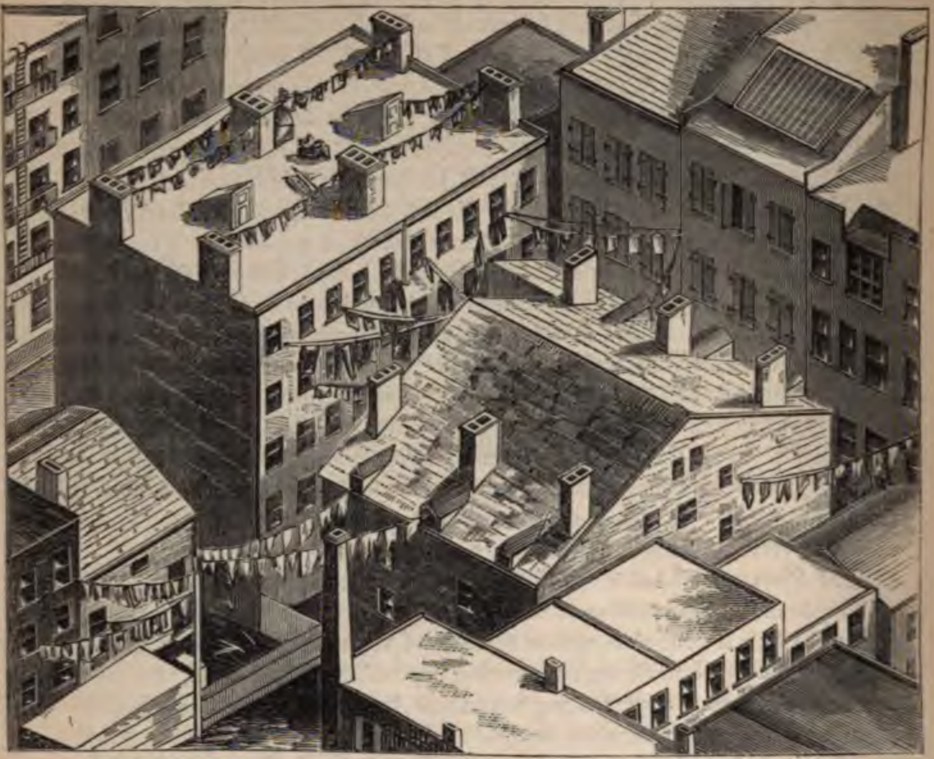
The Tenements at 102 *Bayard Street.*—These tenements abut against the south side of the rear portion of those at 79 Baxter. The house is five stories high; the rear is built close against the side of the rear of 79 Baxter, thereby rendering through-and-through ventilation impossible. This pile of tenements contains a population of 102 persons; there have been six deaths upon the premises during the year, which is equal to a death-rate of 59 persons in 1,000.

The tenements here mentioned, apart from being badly planned, are so constructed, with narrow *cul-de-sac* courts, and with rears built compactly back to back, that on all sides, excepting the street front, they are shut off from sunlight and external ventilation.

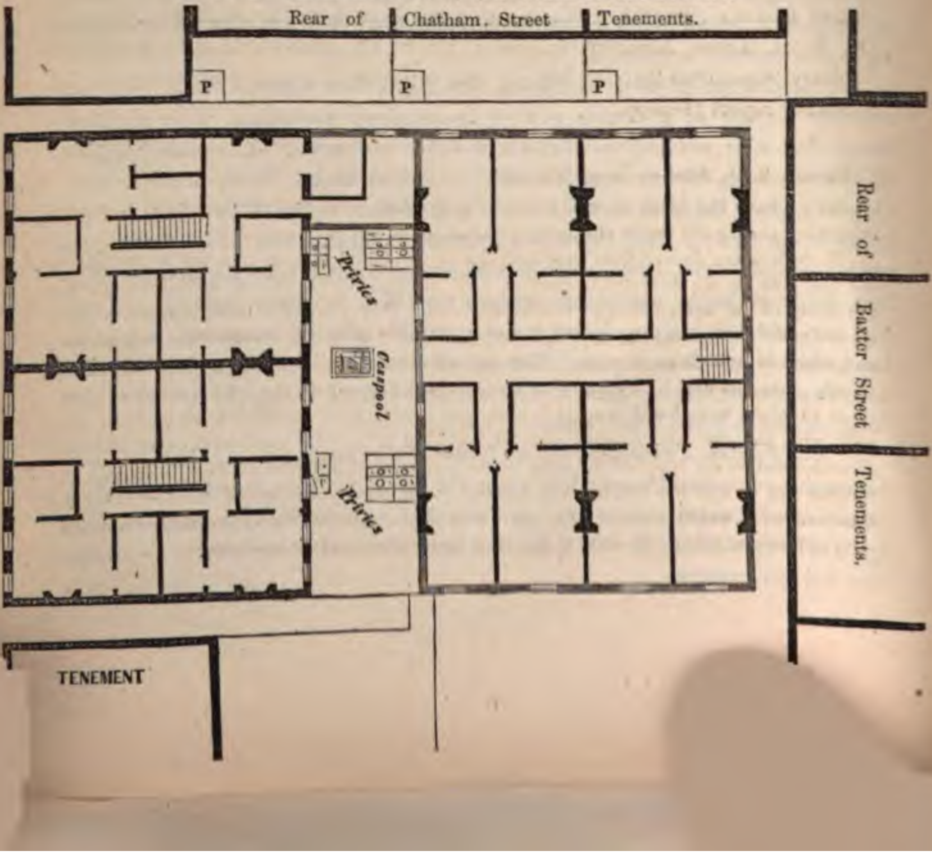
Tenements at 36 *and* 38 *Cherry Street* (*Gotham Court*).—This immense rookery consists of a double row of back-to-back tenements, with an alley seven feet wide between said row and other tenements. The main building is 234 feet long, 34 feet in width, and five stories high. Each domicile consists of a small living-room and bedroom, the former being 14 by 9 feet, and the latter being 14 by 8 feet; these two apartments, living-room and bedroom, together contain about 1,900 cubic feet of air-space; and here the average number of occupants in winter-time ranges from five to seven persons. Nearly ten per cent. of the population residing in this pile of tenements is sent to the public hospitals each year. The rate of mortality, at home and in hospital together, during the last year, and for several years previously, is equal to about forty deaths to 1,000 inhabitants.

"*Old Church Tenements*" *at* 5, 7, *and* 9 *Mulberry Street.*—This mass of tenements comprises the rear half of an old wooden church, in which are forty families, with a population varying from 158 to 200; and, fronting on Mulberry Street, a pile of five-story brick tenements, containing thirty-seven families and 202 persons.

THE "OLD CHURCH TENEMENTS."



PLAN OF TENEMENTS AT 5, 7, & 9 MULBERRY STREET.


Rear of Chatham Street Tenements.
P
P
P
Privies
Cesspool
Privies
Rear of Baxter Street Tenements.
TENEMENT

In this average population of 360 persons, in the front and rear tenements together, there occurred, during the past twelve months, 27 deaths at home, besides several others that were buried from hospital wards, to which this place is one of the largest contributors in the city. Counting only the dead that were buried from this pile of tenements, which covers an area of less than 7,000 square feet, the rate of deaths to population, living therein, at the time, is 75 per 1,000. The diagrams upon the opposite page present the ground-plan and an isometrical view of this home of wretchedness and excessive mortality.

Unhealthful Tenements upon Naturally Salubrious Grounds.—Descending Bayard Street, westward from the Bowery to Baxter Street, we find thirty-eight tenement-houses of the smaller kind, containing, at the time of Inspector Randall's survey in September last, 1,295 persons. The Tenement Mortality Record, for 1869, shows that, in these thirty-eight houses and their population of 1,295 persons, there were forty-eight deaths. This is equal to a death-rate of 38 in 1,000, and is double the average death-rate in the Fifteenth Ward. Yet the hillside here mentioned was originally one of the most salubrious places in the city.

Compliance with the Tenement-House Law.—The rapid accumulation of official complaints by Sanitary Inspectors, as soon as the systematic sanitary survey of tenement-houses was begun, led to close observation upon the kind and degree of compliance that should be given by the owners and lessees of the property complained of, and, at the end of November, I caused a consecutive series of the complaints to be reviewed upon the evidence given by the current indorsements of the official returns on reinspections made by the respective District Inspectors. This review was made upon the records of 4,752 tenement-houses, in which the Inspectors had reported the residence of 39,243 families. The labor of the review has been shared by Sanitary Inspector Dr. E. H. Janes, Assistant Inspector Dr. S. D. Wadsworth, and Assistant-Sanitary Superintendent Dr. Morris, who supervised it, and who has made the following report thereon:

E. Harris, M. D., *Sanitary Superintendent.*

Sir: I have the honor to report that, in accordance with your direction, the following schedule, showing the *results* of inspectors' complaints, has been prepared:

These data are derived from specifications of the complaints, as reported to the Board the past year, by the Sanitary Inspectors, upon the tenement-houses of this city, under the provisions of the act relating to tenement-houses. They show the total number of such houses under each class, viz., 2, 3, 4, 5, and 6 stories, that have been inspected, reinspected, and reported upon from October 1, 1868, to October 1, 1869; the total number of families therein; total number of violations of the different sections of the law; number of times these violations were found complied with, after notice from the Board, or partially complied with, and the total number not yet complied with; the total number of windows recommended to be supplied, in order to improve the ventilation of dark bedrooms, the number put in, and the number yet deficient, under the provisions of the law; also the total number of specific complaints of other neglected conditions for which the law provides.

The following tables will show these totals under their specific headings:

TABLES OF STATISTICS OF REPORTS OF TENEMENT-HOUSES.

Classes of Houses.	No. of houses in each class.	No. of families in each class.
Two stories	244	1,246
Three stories	1,180	6,717
Four stories	2,318	17,766
Five stories	893	11,245
Six stories	1,117	2,269
Total	4,752	39,243

Sections of the Tenement-House Act reported upon.—Times violated, 11,765; times complied with, 7,901; times partially complied with, 441; times not complied with, 3,423.

Ventilation—Windows needed, 46,413; ventilating windows put in, 39,270; windows not yet put in, 7,143.

Hall-roof Ventilation.—Times required, 2,320; times put in as ordered, 1,922.

Specifications of Complaints other than Ventilation.—Cellars occupied, 631; cellars filthy, 599; yards filthy, 691; defective drainage, 917; privies and water-closets, 1,496; want of fire-escapes, 888; necessary repairs, 1,323; no garbage-vessel, 302; owner not on premises, 3,600; owner on premises, 1,152.

No. of Inspections and Reinspections made by Inspectors.—Inspections and reports, 4,752; reinspections, 7,105; total, 11,857.

The main features to which I desire to call your especial attention in this exhibit are the facts of the number of families found occupying these houses, averaging eight and a quarter families to each house, making a total average of forty persons to each house; the increased facilities afforded them, for a more abundant admission of fresh air and light into the dark bedrooms, where, beyond all question, the elements of various diseases of a contagious or infectious nature find their origin. Bedrooms in tenement-houses, as a rule, have been heretofore the small "black holes," where men, women, and children, have been confined for an average period of one-fourth of their lives, breathing over and over not only their own poisonous exhalations, but also those poisonous emanations which adhere to unclean bodies and dirty clothing, from various sources. Personal crowding, bad air, ill-ventilated sleeping-rooms, especially among an unwashed community, generate not only a largely-increased proportion of carbonic acid, but decomposing organic matter, producing atmospheric impurities. The air loses its oxygen and ozone, and thus becomes fearfully vitiated.

These bedrooms are generally found occupied with various articles besides the bed, such as clothing hanging on the walls, trunks, boxes, sometimes decaying vegetables, and other household articles stowed away for want of room. Among these decomposition is going on, giving rise to pestiferous elements, generators or factors of malarial and typhoid poison.

The halls, formerly *culs-de-sac* for impure air, having no outlet either by windows or other openings at the landings of the stairways, are now by means of the roof ventilator thoroughly remedied.

The great good accomplished in enforcing the law's requirements, with special reference to ventilation of halls and bedrooms, cannot but produce a decidedly favorable influence upon disease and the death-record.

The enforced cleansing of the public portions of every tenement-house and yard, removing obstructions from soil-pipes, and emptying and disinfecting privy-vaults, have resulted in the greatest benefit. A constant espionage by frequent visits of the inspectors to this class of buildings has aroused the attention not only of the occupants, but of owners, to the necessity of greater care and vigilance in the sanitary requirements of their domiciles and property. They have also conduced to the advance of general information and intelligence respecting sanitary laws in promoting and preserving the general well-being and public health.

The frequent visits of Sanitary Inspectors have in themselves a moral effect that cannot be overestimated. A better system could hardly be devised by which to reach the uneducated and careless classes. The labors of the Sanitary Inspectors in this direction have created by far the most marked improvement in the sanitary condition of the population of tenement-houses, of any measure ever suggested or practised for their benefit. Publicists and sanitarians have long recognized the want of some organized system by which to reach the unwashed and uncared-for masses. In the quiet, unostentatious visits of the experienced medical Sanitary Inspector, sources of disease are discovered and removed, badly-ventilated apartments are thrown open and exposed to that source of life and health —*pure air*—which through interest, cupidity, or ignorance, has been denied admission; habits of personal cleanliness have been inculcated; advice upon general sanitary questions, vital to every person, has been given; and, from its disinterested and acknowledged professional value, has been received in a grateful and appreciative sense by those to whom it was directly and infinitely invaluable.

Looked upon, as these visits were, at first, with distrust and interference of personal rights, the Sanitary Inspector is now welcomed into those dark abodes of misery and neglect; doors are thrown wide open and hidden sources of disease are exposed to his view. His suggestions and advice are received and acted upon to a degree that it was hardly possible to believe. In the Inspector they recognize their true friend, and many an obscure source of disease is discovered and removed that otherwise would never be reached. The universal testimony of the Medical Inspectors is, that there is less of disease seen among that class, and that there is a much greater general observance of sanitary requirements throughout the tenement-houses than formerly, and that the general information of the people respecting the laws of health is steadily progressing. Conditions formerly looked upon with indifference as necessary evils will not now be tolerated, and in the Board of Health—through its Inspectors—the people acknowledge an executive body, efficient in power, to correct and remove those evils which they have so long endured.

Respectfully submitted,

MOREAU MORRIS,

Assistant-Sanitary Superintendent.

NEW YORK, *December* 18, 1870.

Such results require no comment from the Sanitary Superintendent. They abundantly prove that the toil of Sanitary Inspectors, and the judicious and fearless application of the Tenement House Act by the Board's orders, are not in vain.

The Sanitary Applications of Chemistry.—Prof. C. F. Chandler, as Chemist to the Board, has contributed continually, and in a variety of ways, to the efficiency of the Executive Department. His various reports in a subsequent portion of this volume, relating to water supplies, milk, explosive lamp-oils, the gas nuisance, etc., are but examples of the uses of expert chemical knowledge and analyses applied to practical hygiene and the daily affairs of sanitary government. It has been the Board's good fortune to have the benefit of a very high order of skilled aid and counsel in the department of chemical inquiry and analyses, which have been added to the use of all the resources of the laboratory of the School of Mines at Columbia College.

The maintenance of the analysis of the water-supplies of the two cities, and the analysis of well waters from the various towns of the district, continue to give information that is practically useful, and which will be of permanent scientific interest and value.

Sanitary Inspection of Ships and Emigrants.—The anxiety created by the unfortunate events connected with the emigrant-ship "James Foster, Jr.," which came into port in March, 1869, led to the adoption of a systematic sanitary examination of emigrant-vessels, and the establishment of a periodical inspection of the water side, with its wharves, shipping of certain classes of vessels, lodging-houses, and seamen's boarding-houses. This duty was intrusted to Sanitary Inspector Dr. A. B. Judson, late of the U. S. Navy, and to the very instructive report (in a subsequent part of this Appendix), which he has made concerning this difficult class of duties, I respectfully invite attention. The facts presented in that report, in regard to the unhealthful and hazardous conditions in which he has found many of the forecastles on board merchant-ships, and his testimony concerning the hazardous management and sale of old bedding from emigrant-ships, should receive attention from all parties concerned. The neglect of the sanitary wants of the forecastle and of the common seaman is a cause of wide-spread evils and immense losses, that ought not to be overlooked. The fatal typhus and scurvy in twenty seamen of the "James Foster, Jr.," and the strange fever that appeared on board and at the dock of the Italian bark "Chiara," caused more public anxiety and did more harm than all the yellow fever that has reached the port of New York the past three years.

Reports by Sanitary Inspectors.—It has been deemed proper to have each medical officer make his annual report in such form as to be contributed to the Board's report for this year. These inspectorial reports will be found herewith appended. They are complete for all the sub-districts, excepting only for that of the lamented Dr. F. J. Randall, the late Inspector for the 6th and 14th Wards. He died on the 25th of December, before he had opportunity to prepare his report. An illustration and diagram of an unhealthful block of tenements, that he was endeavoring to reform, are placed upon a preceding page of this report, as an example of one of the many contributions of that most industrious and faithful officer in the work of sanitary improvement.

The Annual Report of Dr. R. C. Stiles, Assitant-Sanitary Superintendent, Brooklyn.—In his report for the executive department in Brooklyn, Dr. Stiles this year combines his usual report on the study he has made of the Vital Statistics in that city. The medical officers of his department under the Board have also contributed reports which embody facts of practical interest.

For the various abstracts and notes relating to Vital Statistics, to the labors and results of sanitary inspection, the work of vaccination, the records of small-pox, and such other subjects as might properly be comprised in the Sanitary Superintendent's report, I have the honor to refer to the various reports and appended statements which here follow.

Very respectfully submitted,
E. HARRIS, *Sanitary Superintendent.*

ANNUAL REPORTS OF SANITARY INSPECTORS.

DISTRICT No. 1.

ELISHA HARRIS, M. D., *Sanitary Superintendent.*

SIR: I have the honor to submit the following annual report of the duties performed by me, as Sanitary Inspector of the First District, together with an account of the changes that have taken place in said district.

Boundaries.—Commencing at Pier No. 1, North River, running up to Canal Street, up Canal to Broadway, down Broadway to Liberty Street, down Liberty Street and Maiden Lane to the East River, thence around the water-edge to the place of beginning, and including the First, Third, and Fifth Wards. This district has a large water-front, adjacent to which the land is but little elevated above tide-water, and is wholly of made ground, lying outside of the original shore-line.

This artificially-formed portion of the district, from its slight elevation above tide-water, is constantly saturated with moisture, so that cellars and basements of dwellings erected on it are damp and insalubrious, and at times, during very high tide, uninhabitable; while, from its too level character, the drainage is imperfect, and street-gutters are obstructed with all sorts of filth. The dampness of the cellars and basements, together with the accumulated filth in the gutters, is the primary cause of rheumatic and other inflammatory diseases so prevalent among the class of people who inhabit such abodes. They are known as boarding and lodging houses, and are frequented by the floating population, viz., sailors, prostitutes, and vagabonds of every description, who carry disease with them wherever they go.

Since the organization of the present Board of Health in the spring of eighteen hundred and sixty-six, particular attention has been paid to the sanitary condition of these low, dark, and poorly-ventilated apartments. Nearly all of them have undergone a transformation. If the Inspector found a cellar occupied for human habitation, his first inquiry would be, can it be so altered in its structure as to comply with certain requirements of the law passed May 14, 1867, which says: "From and after the first day of July, eighteen hundred and sixty-seven, it shall not be lawful, without a permit from the Metropolitan Board of Health, to let or occupy, or suffer to be occupied, separately as a dwelling, any vault, cellar, or underground room."

If this portion of the Tenement-house Act had been rigidly enforced at once and indiscriminately, our charitable institutions would have been crowded to excess.

Consequently, only those of the worst kind were ordered to be closed, while other unwholesome places were so altered by draining, lighting, and ventilating, that they were permitted to be used for cheap habitations, until some other and more suitable places could be provided for these unfortunate people.

During the time since this law was passed by our Legislature, eighty-six of these permits have been temporarily granted by the Board in different parts of the first district. Of these permits, the largest number (43) are in Greenwich Street, and are generally occupied by prostitutes of the lower class.

Most of the tenement-houses in this district were originally built to be occupied by private families or as stores. On this account, they are not well adapted to their present uses, and it is very difficult to alter them so that they will conform to the various sections of the present law. Notwithstanding these difficulties, owners and occupants have cheerfully complied with all orders emanating from the Board of Health; such as ventilating the close rooms, keeping the areas, yards, and privies, in a more cleanly condition.

During the past twelve months, many of the old and filthy privy-vaults have been done away with, and modern water-closets substituted; while others have been connected with the street-sewers, in accordance with the regulations of the Croton Board.

Until within the last year, there were several streets, or parts thereof, that had no regular sewer in them; consequently, owners of large tenement-houses were obliged to call upon the scavenger once or twice a year. The changes that have taken place throughout the First, Third, and Fifth Wards, since my last annual report, are remarkable in a business point; entire blocks that were, one year ago, old, dilapidated tenement-houses, are now honored with splendid marble edifices, to be used for commercial purposes. The time is not far distant when the present tenement-house property of this district will be converted into stores, warehouses, and manufactories.

Wharves and Piers.—The piers on the North River are in better order than those on the East River. Owners and lessees have repaired them as well as possible, yet many of them are in a condition dangerous to life, and detrimental to the public health, for the following reasons:

They were originally built of wood, which is now decaying and falling to pieces.

This rotten wood forms a compound with the putrescent filth that empties into the river from the numerous street-sewers, which, when agitated by tidal waves, or moving vessels, emits gases of the most offensive and sickening character.

This river filth is never entirely removed from the water-side, because the upright logs, or piles, that form the dock, act like a sort of net-work, to prevent the tide from washing it away. During the hot summer months, decomposition is much more rapid than at other times, and, in my opinion, this is the cause of the many deaths from diarrhœal diseases in this particular part of the city.

The old system of wooden docks will eventually (as a public necessity) be done away with, and metal or stone work substituted, and so arranged in their architectural structure as to allow free flow of the tide, without the possibility of the retention or accumulation of filth of any kind.

Markets.—The improvements in our public markets cannot be mentioned. The old wooden and dilapidated Washington Market remains in the same condition as when I last reported it. The same can be said of its offshoot, West Washington Market. The passage-ways approaching either of these markets are becoming more and more obstructed by all sorts of retail market-stands. With the exception of the vicinity of this market, the different streets have undergone a favorable change during the past year. Many of the most uneven and poorly paved have exchanged the old cobble-stones for Nicholson or Belgian; among this number, I will mention Bridge, Rector, Liberty, West, Barclay, North Moore, Murray, and Canal.

In conclusion, I will say that the whole number of tenement-houses in this district is about six hundred. On an average, each house is occupied by six families, each family containing five persons, making an aggregate of about eighteen thousand tenement-house population.

During the months of June and July this entire number was offered free vaccination. (For particulars of vaccination, I respectfully refer to Inspector Janes's Special Report.)

I have made a sanitary survey of—

Tenement-houses	600
Business-house cellars	785
Wharves and piers	71
Private houses	595
Market-stands	171
Sanitary survey (squares)	127

Respectfully submitted,

W. F. DEMING, M. D., *Sanitary Inspector.*

NEW YORK, *December* 31, 1869.

DISTRICT No. 2.

NEW YORK, *November* 1, 1869.

ELISHA HARRIS, M. D., *Sanitary Superintendent.*

SIR: In presenting the Annual Report for the Second District, it will be necessary to state, first, that the period of service of its present inspector dates from the 1st of October of the present year; yet the sanitary survey of the district has been carried on during the same time that the work progressed in the other inspection districts.

The Second District comprises that portion of the city known as the 2d and 4th Wards, bordering on the East River, and bounded by Liberty Street, South Street, Catherine Street, Chatham Street, Chatham Square, Park Row, Broadway, and Maiden Lane, and is occupied by buildings for mercantile and business purposes, tenement-houses for laborers, 'longshoremen, sailors, and mechanics, and a few dwellings for those in moderate circumstances. Nearly one-half of the district is occupied for wholesale business-houses, comprising the whole of the 2d and a portion of the 4th Wards. Yet here and there, in the midst of warehouses, stores, and offices, the *regular tenement-house* towers, tier upon tier of storied height, all alive with the noisy voices of its crowded tenants, from court to attic; and along the river-belt, in the length of three parallel streets, is the cellar-population, burrowing into the oozy soil of this filth-sodden quarter, to find a home under ground and below the tide-level. In Water, Cherry, Batavia, and Oak Streets, the tides ebb and flow in the subsoil around the most of these homes, which are always dark, damp, and unhealthy. But the Board of Health has done a good work in causing the worst of the inhabited cellars to be vacated, the record of which will remain in all after-time a mark of its service in promoting the health of the humblest class of citizens. Some of these cellars are inhabited by laborers and sea-faring men of dissipated habits, who take refuge almost anywhere to lodge when late hours overtake them, and poverty or depravity finds in these dismal cellars a shelter and temporary dwelling-place.

It may be stated that the streets devoted to business purposes wholly are Broadway, Liberty, Front, Maiden Lane, Burling Slip, John, Fulton, Beekman, Nassau, William, South, Gold, Cliff, and Spruce Streets; those partially so, and interspersed with tenement-houses and dwellings, are Rose, Dover, Frankfort, Vandewater, Ann, Pearl, Water, New Bowery, New Chambers, Chatham, and Catherine Streets; while those wholly or almost entirely devoted to thickly-populated tenement-houses are Roosevelt, James, Cherry, Oak, Oliver, Madison, and Henry Streets.

The elevation of the highest portion of the district is thirty-six feet above the tide, and is on the corner of Chatham Square and Catherine Street, and the lowest portion is on the corner of Peck Slip and Front Street, three feet above the tide, and is the direction of the principal sewer outfall.

About one-sixth of the whole area is artificial or "made ground," reclaimed from the original swamp and river-front, and influences to a great extent the health of the population occupying these low portions of the district.

The results of experience in this district, in applying the improvements required under the tenement-house law, show the actual necessity for all that this law provides concerning the ventilation of rooms and bedrooms of tenement-houses.

In seven squares in which the tenement-house population is most numerous in this district, there are one hundred and four tenement-houses, the average cubic air-space per occupant in which is as follows:

1	tenement-house,	allowed	per occupant,	180	cubic feet.			
16	"	"	"	200	"	or below	300	cubic feet.
20	"	"	"	300	"	"	400	"
15	"	"	"	400	"	"	500	"
16	"	"	"	600	"	"	700	"
11	"	"	"	700	"	"	800	"
8	"	"	"	800	"	"	900	"
2	"	"	"	900				

In sleeping-rooms the average cubic space is:

3	tenement-houses,	allowed	per occupant,	120	cubic feet.			
1	"	"	"	178	"			
1	"	"	"	150	"			
3	"	"	"	190	"	or below	200	cubic feet.
34	"	"	"	200	"	"	300	"
26	"	"	"	300	"	"	400	"
7	"	"	"	500	"	"	600	"
7	"	"	"	600	"	"	700	"
4	"	"	"	700	"			

Impure air is the chief cause of much of the misery of the poor. It generates uncleanliness in the domiciles, and involves ill-health and early death to the occupant. Deprived of the natural stimulants of fresh air, Nature impels the individual to seek the poisonous and temporary stimulus of alcohol to supply its place. These facts are plain to every intelligent observer. If a person breathes fourteen cubic feet of air per hour, this quantity of air when returned from the lungs, exhausted of the vital element, oxygen, becomes charged with carbonic-acid gas to that extent that it vitiates one hundred cubic feet of air more. So that it becomes a subject of paramount necessity that some special legislation be had to provide the means by which a constant and abundant supply of pure air may be obtained in these "close, uncleansed, unventilated residences of the poor."

Then, the supply of light also is a necessity that forces itself upon the attention of the sanitarian wherever its deficiency is found. Dr. Barton has said: "The admission of light is important, in the construction of a dwelling, to the enjoyment of health and the prevention of disease. It renders disease milder when it occurs, and makes it more readily amenable to medical and other treatment. There is reputable medical testimony to prove that some diseases, in dark alleys and cellars, cannot be cured without it. Dark passages and corners in dwellings are always the hiding-places of dirt and filth, and particularly in the habitations of the poor."

Overcrowding and domestic uncleanness are still the source of the greatest sanitary and social evils of this district. Although business is crowding upon the area of the district, yet the population remains about the same as before. There are cases where the front and rear buildings are situated on lots less than eighty feet deep. It can be readily perceived what a baneful effect upon the health of the surrounding community neglected privy-vaults, filthily-kept stables, foul courts and alleys, or obstructed drains, would be in a thickly-populated neighborhood. It is in these sources of disease that pestilential fevers have their origin. The presence of these privies in the crowded portions of a tenement class of people can be detected in any part by their peculiar odor.

In the last of the cellars inspected (44 Oliver Street), of 3,028 cubic feet capacity, were found twelve occupants and their five beds, with windows and doors closed, smoking, cooking, drinking, and living here, unconcerned in this polluted atmosphere, in close proximity to a dozen stables and a neglected privy, with its obstructed drain in the rear.

The cellars and basements of the district are the most liable to overcrowding of any part of the houses, on account of the facility to take in at night as many "lodgers" as can be *packed;* and, when the cellar is full, the out-houses of the backyard are a refuge for other homeless persons.

In reference to *nuisances*, there can be but one opinion by every educated and experienced sanitarian. In any thickly-populated district of the city the cellars are not to be tolerated. A neglected privy may be the fountain-head to which can be traced the most dreaded of fevers—typhus. A filthy cellar, court, or stable, or the failure to remove refuse, garbage, etc., regularly and daily, and the neglect to thoroughly cleanse the gutters and streets, may be the prolific causes of cholera-infantum, diarrhœa, and dysentery. The happy results from the action of the "Board" in abating these nuisances have been exemplified in the mitigated forms of epidemic disease that have occurred since its organization—first cholera, then typhoid fever, then scarlatina and rubeola, and lastly small-pox. The futile efforts of these epidemics to resist the strong work of sanitary reform, and to spread disease and panic throughout the business portion of our chief commercial city, occasioned some in our midst to doubt their existence; but, in the case of cholera, so completely was the disease held at bay, that it may be considered proved beyond a doubt that there is a necessity for the good work of sanitary reform to go on.

The wants of a metropolitan city are different from those of a town, and we are compelled by necessity to keep pace with its continued growth, and to constantly supervise its increasing demands for healthful regulations. There is still much indifference to the danger of contagious maladies among the demoralized inmates of tenement-houses, and an utter disregard of prophylactic measures on the part of agents and landlords.

1. The chief points for sanitary improvement in the district seem to be the withholding of "permits" to occupy as human habitations and lodgings such cellars and basements as are deficient in proper ventilation, drainage, air-space, and good supply of light, on account of their pernicious effects upon the health of the occupants.

2. The raising of the grade of Cherry Street, and the adaptation to its grade of the adjacent streets.

3. The gutters and streets should be more regularly and thoroughly cleaned. The more dense the population the greater is the effort necessary to insure cleanliness.

4. Continuing to construct a thorough system of sewerage so that every lot may be effectually drained.

5. Introducing improvements in the houses, where it is possible, to prevent overcrowding, and securing ventilation to halls and sleeping-rooms.

6. The enforcement of regulations in reference to vaccination.

7. The adoption of persuasive means to spread correct information among the people concerning hygienic laws, so that they may intelligently see for themselves that it is to their own interest to conform as near as possible to the benign laws of health; that by so doing they are rendered far healthier and happier, and their children more vigorous and long-lived, and their condition in life elevated to that standard which represents the self-reliant, reflective, and honest citizen.

Abstract of Records of the Tenement-house Survey.

Total number of blocks or squares	80
" " " tenement-houses	411
" " " private "	352
" " " stables (not stalls)	43
" " " other structures	1,752
" " " families in tenement-houses	2,461
" " " persons " " "	10,484
Average families in " "	10
" persons " " "	30
Largest number of families in one tenement-house	100
" " " persons " " " "	400
Average cubical space to each in living-room	400 ft.
" " " " " sleeping-room	250 ft.
Total privies and water-closets	2,131
" with sewer connections	2,070
" without sewer connections	61

Respectfully submitted,

O. G. SMITH, M. D.,
Assistant-Sanitary Inspector.

DISTRICT No. 3.

NEW YORK, *November*, 1869.

ELISHA HARRIS, M. D., *Sanitary Superintendent.*

SIR: I have the honor to report, as follows, the condition of the Third Sanitary District of the city of New York, from January 20th to October 31st, inclusive, 1869.

This district is bounded by Jefferson, Norfolk, and Rivington Streets, and the East River, including the upper half of the 7th and all of the 13th Wards.

The squares that are directly adjacent to the river are mostly occupied by warehouses, and the various manufactories connected with shipping.

That portion of the district bounded by Gouverneur, East Broadway, Jefferson, and Monroe Streets, is occupied by private residences, most of the houses being inhabited by the owners, and being in good sanitary condition. The other portions of the district are occupied by tenement-houses and private dwellings (the latter being usually occupied by two or three families), and scattered in among them are stables, manufactories, etc.

The general surface of the district presents a hillside, having its apex at the corner of Attorney and Grand Streets. This is the highest ground in the district, being forty feet above tide-water, and from this point is a gradual slope to the water's edge. That portion of the district bounded by East Broadway, Jefferson, and Montgomery Streets, was originally marsh land, supplied by a pond at the corner of Henry and Jefferson Streets. At the junction of East and South Streets, the river makes an abrupt bend, and thus naturally divides the river border of the district into two portions.

On the south side, the original water-line was about where First Street now is, so that we now have about 200 feet of made land along the entire front.

On the east side, the original water-line extended from the juncture of Front and Corlears Streets to Lewis and Rivington Streets; the water-line now is about 600 feet beyond this.

The estimated population of the district is about 50,000.

The tenement-houses in the 7th Ward portion of the district consist mostly of old buildings, formerly occupied by one family each, but, owing to the change which has taken place in the character of the inhabitants of this portion of the city, they are now occupied by from three to ten families. These houses are the ones, in my experience, which have given the most trouble to the Board, owing to the lack of proper ventilation and sewerage.

But, in this particular, the good work the Board has done is very noticeable to any one who knew the condition of this portion of the city some four or five years since.

In the 13th Ward portion of the district, the tenement-houses which are occupied by more than four families are, in most cases, houses which have been built with a view to this manner of occupancy; and some few of them are so perfect in their details, both for health and convenience of the occupants, that they might well serve for models for others to follow: for instance, the premises Nos. 31 and 33 Ridge Street, front and rear.

The necessity of a rigid enforcement of that portion of the second section of the Tenement-house Law, requiring two ventilating windows in all sleeping-rooms not having direct communication with the external air, is, practically, one of the greatest importance. In the houses originally intended for the occupancy of one family, but now occupied by several, is this improvement the most noticeable. Formerly, rooms designed to be used as closets without *any* windows were, in many instances, used as the sleeping-apartment of a family of three or four persons, allowing, in most cases of this kind, an average of only 75 or 80 feet of air-space to each person. Now, by requiring two windows on opposite sides of the rooms, thus giving a current of air directly across, a good supply of air is diffused throughout the entire apartment.

Throughout the entire district the privy-vault is used in preference to the water-closet in the proportion of about six to one, and, I think, with advantage.

The great drawback to the proper cleansing and preventing obstructions in the sewer connections, in the case of water-closets, is the lack of sufficient water supply for the purpose of flushing.

If some means could be adopted whereby the river-water could be used for this purpose I think it would be very beneficial to the health of the entire community.

Nearly all of the very bad cellars which were formerly occupied as dwellings for families have been vacated, and several of the better ones are now under orders for improvement, so as to require through-and-through ventilation and proper drainage.

Although it may seem a great hardship, to a person unacquainted with the inhabitants of these cellars, as a class, to require them to vacate the premises which they occupy, at what might be supposed to be a low rent, still I have found, with but two exceptions, that the amount of rent paid is enough to obtain suitable apartments above-ground, and that the only person deriving any benefit from such occupancy is a lessee, or some third party acting between the owner and occupant.

In point of cleanliness, much improvement is now seen by those who have followed the workings and orders of the Board; but in those houses where the plan of having a housekeeper is adopted, or some one to whom the owner gives a room or two, rent free, to take a general supervision of the cleaning, etc., is the best condition found, though the premises may be occupied by the lowest classes.

The filthy condition of the streets is one of the greatest nuisances with which we have to contend. In those portions of the city occupied almost exclusively by tenement-houses, once a week is not often enough to remove the accumulations of filth from the streets; in my opinion, it should be done at least twice a week, and then in a thorough manner.

The promptness with which the orders of the Board are now complied with in the majority of cases, is very gratifying to all who have the interests of the tenement portion of the population of our great city at heart, but to none more so than the Inspector.

In all cases where I have been able to do so, I have held converse with the owners of the property, and in these instances I have been much gratified to find how willing and ready they are to make the required improvements, usually finding them completed at the time of reinspection, 14 days after.

The following is a summary of the number of inspections and reinspections made by me from January to November, 1869:

Tenement-houses	972	Cases of contagious disease	38
Private dwellings	364	Drains and sewers	41
Privies and water-closets	612	Fat-boiling establishments	17
Cellars and basements	238	Coal and wood yards	13
Manufactories	87	Sidewalks and gutters	27
Stables	197		
Warehouses	32	Total	2,842
Yards, courts, and areas	184		

The Sanitary Survey shows the number and kinds of structures by which this portion of the city is occupied, to be as follows:

Tenement-houses	916	Manufactories	224
Private dwellings	1,692	Lumber, coal, and iron yards	73
Stores	960	Warehouses	41
Stables	284	Other structures	41

Consolidated Statistics of the Tenement-house Survey:

Total	number of	tenement-houses in district	916
"	"	families residing in them	6,698
"	"	persons	28,438
Average	"	families in a house	7
"	"	persons	29
Largest	"	families	28
"	"	persons	112
Total	"	houses with privies	169
"	"	" " water-closets	611
"	"	" " sewer connected	779

Respectfully submitted,

CHARLES F. ROBERTS, *Sanitary Inspector.*

DISTRICT No. 4.

ELISHA HARRIS, M. D., *Sanitary Superintendent.*

SIR: I have the honor to respectfully submit the following report upon the general sanitary condition of the Fourth Sanitary District for that portion of the past year between January 21st and November 1st.

The Fourth Sanitary District includes the whole of the 8th Ward, and that portion of the 15th lying east of University Place and Wooster Street.

The 15th Ward is mostly occupied by private residences, there being but few tenement-houses, and those situated east of Broadway.

The 8th Ward is largely occupied for business purposes, especially the southeastern portion, and those streets traversed by railroads.

The streets running east and west are as yet mostly occupied as places of residence; but, as the business of the city progresses up town, residences disappear and warehouses take their places. This is clearly shown by the rapid demolition of the old houses in the lower part of Mercer, Greene, Wooster, Howard, and Grand Streets, their places being now occupied by massive marble and iron structures.

The tenement-houses are located in no particular district of the ward, being found upon every street.

The following tabulated statement shows the total number of inspections and reinspections made in the district between January 21st and November 1st:

Total number of tenement-house inspections	1,302
" " " cellar inspections (special)	88
" " " vacant lots (special)	6
" " " privies and water-closets (special)	95
" " " privies and water-closets	530
" " " alleys, courts, and yards (special)	35
" " " chicken butcheries	1
" " " stores, shops, and manufactories (special)	46
" " " stables inspected	212
" " " hydrants and leaders (special)	18
" " " streets and gutters (special)	55
" " " contagious diseases	12
" " " private houses inspected	422
Total number of inspections and reinspections	2,322

The above shows the total number of inspections and reinspections made throughout the entire district. The following table shows the number of squares of sanitary survey made, with the number of tenement-houses surveyed, and the sections of the "Tenement-house Law" found violated; also the number of families, and the number of persons in the houses surveyed, with any other minutiæ connected with the work:

Total number of tenement-houses surveyed (to October 15th)	311
" " " squares surveyed	29
" " " families in houses surveyed	1,883
" " " persons " " "	7,003
Average number of persons in houses surveyed	2,250
" " " families " " "	5
Largest number of families in a house	20
" " " persons " "	67
Total number of houses with water-closets	25
" " " " privies	286
Number of violations of Section 2	233
" " " 4	87
" " " 5	143

Number of violations of Section 6	88
" " " 8	297
" " " 9	261

The Board has in no instance found it necessary to execute its own orders, and in but few cases has it been obliged to resort to a suit to enforce compliance, the owners of property showing a remarkable willingness to comply with all orders made.

Privies.—The offensive condition of all privies, even those with sewer connections, has caused the inspector to arrive at the conclusion that the total abolition of all of the old style of privy-vaults, and the substitution of water-closets, would be of very great sanitary advantage to the city, as it is a well-established fact, among the most experienced sanitary observers, that the emanations from accumulated cloacal discharges is the great source of diarrhœal disease and mortality, especially among children.

The objections that are made against water-closets, that they are easily obstructed, are not to my mind weighty in comparison to the great benefit to be derived by their adoption, especially among the tenement-house population.

If the tenement-house population are once educated (and it is only by education that they can be reached) up to the point of seeing the great benefits to be derived by the adoption of water-closets, they would, as a matter of self-interest, keep them free and clean, as the interest of self-preservation is as strong among the ignorant as it is among the refined and educated.

Stables.—The stables of this district are, as a rule, in bad sanitary condition, there being, in most cases, no manure-vaults; and, even where there are, from the manure being scattered over the yard, or into the street, the fact of there being a manure-vault is no guarantee that the manure is not exposed to the action of the sun and rain, as the owners of the stables are not particular in having the vault emptied before it is quite full. When the vault is full, the remainder of the refuse is exposed upon the street or in the stable-yard.

There are a few model stables in the district; that of Henry Hughes, in Charlton Street, is perfect in every respect. The floor is water-tight, and a concrete valley-drain runs along behind the stalls; this drain is connected with the sewer, so that all drainage from the stalls is immediately conducted away. Water is also supplied for flushing. The manure is in a tight vault, so that the odor peculiar to a stable is scarcely perceptible. The whole stable is clean, and is much less offensive than many tenements. The stables of the National Express Company, in King Street, are of the same character.

Garbage.—What to do with garbage until it is taken away by the contractor is a question that has been asked over and over again, and no satisfactory answer has been obtained. That there must be a receptacle provided by every tenement-house-owner is an admitted fact, but what this receptacle shall be has not been determined as yet.

I am of the opinion that an iron vessel of some kind, that is entirely above-ground, will be found to be the only contrivance that can be used with success, for these vessels must combine utility with cheapness. All of those boxes which are set into the ground are expensive, and objectionable for the reason that in winter the receptacle for the garbage-box will become obstructed with snow and ice, preventing the closing of the cover, thus encumbering the side-walk, if they are placed there, or the hall or yard, if these places are selected. Something must be done to keep the streets free from garbage, as the best-directed efforts of the street-cleaning contractor are useless under the present arrangement.

Ashes.—The question of what to do with ashes follows in the train of the query about garbage. The same solution that solves one will settle the other, excepting that the ashes and garbage should be kept in separate vessels for commercial reasons. The ashes to be used as fertilizers, and the garbage as food for swine. By following such a course thousands of dollars could be saved to the country annually.

Tenement-Houses.—Much improvement is being made in the construction of tenement-houses, but perfection is far from being reached as yet.

Most of the houses which are now occupied as tenements were originally built for private houses; but, as the localities in which they were situated became undesirable for private residences, they have been altered so as to accommodate from four to eight families, and in their alteration the idea of ventilation has been almost entirely ignored; but, under the healthful teachings of the Tenement-house Act, the owners have inserted windows in unventilated bedrooms, and ventilators in the roof at the top of the hall, thus making what were formerly dens of death comparatively healthy domiciles. Many of the bedrooms in these houses do not include more than six hundred cubic feet of air-space, which, if occupied by only one person, is scarcely sufficient to support life; but, when divided between two, and sometimes three and four, the result can only be death to some or all of the occupants if they are left without ventilation. The improvement in the death-rate of tenements during the past year proves conclusively the good effects of proper ventilation and drainage.

The drainage of the houses has been much improved within the past year. Cellars which were once damp are now dry, and yards and areas, which were flooded by every summer-shower, have been so graded and connected with the street-sewer that all surface-water is conducted away, and not left to stagnate and breed disease.

Cellars.—There has been much improvement made in the construction of inhabited cellars during the past summer. Those cellars which were damp, owing to the want of proper areas, have had areas constructed, thus rendering them comparatively healthful. Many cellars on Greenwich, Washington, Laurens, Thompson, Sullivan, and Canal Streets, have been vacated by order of the Board, and permanently closed.

Sewerage.—The highest point in the district is at the corner of Elizabeth and Houston Streets, it being forty-six (46) feet above tide-water. The lowest point is at the corner of Canal and Thompson Streets, it being but two feet three inches (2 ft. 3 in.) above tide-water.

The sewerage of the southern portion of the district is very defective, especially that portion which formerly constituted the "Lispenard" meadow. Here, in consequence of the lowness of the ground, and the resulting height of the sewers, no drainage is afforded to the cellars or privies; consequently the privies are always full, and the cellars damp. In many of the cellars on Laurens, Thompson, and Sullivan Streets, water stands, as a rule, from one foot to eighteen inches in depth most of the time.

This condition can only be remedied by raising the grade at least ten feet of all that portion of the 8th Ward. This question of the more perfect sewerage of this part of the ward will become of more and more importance every year, as the tide of commerce flows northward across Canal Street.

There is great need of sewers in the following-mentioned streets: University Place, Greenwich and Washington Streets, from West Houston to Charlton Streets, Hudson Street, from West Houston to Spring Streets. There have been sewers laid in the following streets during the past year: Varick Street, Vandam Street, and Watts Street. Many of the houses on these streets have had sewer-connections made, and many others are now being improved in the same manner.

Water-Courses.—There was but one natural water-course in this district, that was the "Minetta Stream;" it entered the 8th Ward, at the corner of Varick and West Houston Streets, thence running southwest to near the corner of Hudson and King Streets it divided, one branch running north to Houston, thence south, down what is now Greenwich Street, to the corner of Charlton; the other running southwest, from the corner of Hudson and King Streets to the corner of Charlton and Greenwich Streets, where it united with the main stream, thence running west, emptying into the Hudson River, at what is now the foot of Charlton Street.

The track of this now-obstructed natural water-course has been the location of cholera in every epidemic that has visited New York since this part of the city has been settled.

The lesson that has been taught here should not be neglected in those portions of the city in which natural water-courses yet exist.

Respectfully submitted,
GEORGE B. SMITH, M. D.,
Assistant-Sanitary Inspector.

NEW YORK, *November* 1, 1869.

DISTRICT No. 6.

Elisha Harris, M. D., *Sanitary Superintendent.*

Sir: I have the honor to submit the following report upon the general sanitary condition of the Sixth District, for the last nine months.

This district is bounded by the south side of Sixth Street, the north side of Rivington Street, west side of Avenue B, and the east side of the Bowery, being the southerly half of the 17th Ward. The population is principally German, a great number are from Bohemia.

The western section, from Second Avenue to the Bowery, is occupied principally by private houses and shops, while the east side of the Second Avenue is almost entirely occupied by tenement-houses, and is in a fair sanitary condition. The avenues and streets are principally occupied by small store-keepers, the Bowery being the greatest thoroughfare.

Tenement-Houses.—There has been a very decided improvement in this class of dwellings during the past nine months, the reason being the rigid enforcement of the Tenement-house Act, which gives to the poor better dwellings, and a proper source of authority to which they may appeal for repairs which are neglected by careless landlords.

The tenement-houses in this district may be divided into three classes: 1. The newly-built houses, which are generally located west of Avenue A. 2. The older built houses, which are situated generally south of Fifth Street, and east of Avenue A. 3. Wooden tenements, which are to be found in Norfolk, Suffolk, and other streets mostly south of First Street.

The first-class houses mentioned are generally four and five stories, double, and contain from ten to twenty families, and were found to need but slight, although important, alterations to conform to the requirements of the law; these houses (rear houses excepted) are a great deal better lighted than the older or second-class dwellings, the sleeping-rooms each having windows into the hall and adjoining rooms, or direct communication with the external air, when fully conforming to the law, making the rooms and halls lighter, and increasing the circulation of fresh air. In this class of houses, it is a rare occurrence not to find narrow windows over and along the doors (the entire width); this, together with a bulkhead and sky-light on the roof (which generally coexist), afford a good light to the halls, while the doors and ventilator on the roof admit a current of pure atmosphere.

The law has also proved a very great benefit to the poor tenants in preventing the construction and extension of rear tenements within a certain distance from the front houses, thereby preventing the huddling together of the poor occupants, as if there were no difference between human and that of brute life. The greatest degree of overcrowding of area in the Sixth District, is on the south side of Fourth Street, between Avenues A and B, where there are some sixteen houses four stories high, all in one block, the greatest distance between front and rear being not more than ten feet. The rear houses are generally damp and mouldy, the sun's rays seldom, if ever, penetrating the apartments. In rear houses and cellars a vast excess of chronic and acute disease is always found, and this is evidently the result of continual dampness, which impoverishes the blood, and gives rise to phthisis, rheumatism, scrofula, etc.

The second or older class of tenements are occupied by from four to nine families, and are mostly situated east of Avenue A, south of Fifth Street, and are generally not more than three stories high, and, in most instances, consist of two dwelling-rooms, four bedrooms, and occasionally two additional sleeping-rooms (used as kitchens), to a floor. This class of houses, as a general thing, required more alterations and repairs in order to fully comply with the needed requirements. A number of these houses belong to estates of deceased persons; some are on leasehold ground, and consequently there is greater delay in making the improvements than in the first class. The halls, also, are generally darker and more poorly ventilated, the construction of the bedrooms and kitchen preventing the halls from being properly lighted, there being but one window into the hall, and generally no window over the door. However, there has been as great an improvement in this class of dwellings as law and morality will admit of.

The third class which I refer to are wooden, and, fortunately, are but few and scattered in this district. These also show considerable marks of improvement, and thorough overhauling; leaky roofs, ceilings, walls, banisters, privies, yards, and drains, have been repaired and cleaned when out of order.

The tenants seemed to be very grateful and thankful to think that they had some source of authority to appeal to, and look to the Board of Health as their benefactors. I am certain, from the reception I have received, and the kindness shown me by the occupants, that they fully acknowledged and appreciated the surveillance of the Board over careless and avaricious landlords, and I think that some means were essential to protect the poor and helpless tenants, and to see that they had comfortable homes.

Cellars.—This class of underground habitations, in my opinion (and I am certain that I express the desire of every medical member of the Board when I say it), should cease to exist. Although, in the district that I have been placed in charge of, the majority of them are of the better class, I have inspected over one hundred and fifty, all of them having required some alterations before a permit for occupancy would be granted by the Board of Health, the most frequent causes of complaint being a deficiency of ventilation, improper drainage, and offensive odors in the apartments, from defective privy and sewer connection, and also nonconformity to the sixth section of the Tenement-house Act. These cellars, notwithstanding their improved condition, cannot be kept entirely dry on account of their surroundings. There is always a damp, musty smell, which is not perceptible to the persons who inhabit them, on account of long residence. Several property-owners, not desiring to make the necessary alterations, have had the cellars vacated as habitations, and rented as workshops, kitchens, etc. The sub-cellars have also come in for a good share of attention, and, when complained of as being offensive, an order from the Board requiring cleanliness is promptly issued and rigidly enforced.

Courts, Alleys, Areas, and Yards.—The sanitary condition of the yards, courts, areas, and alleys, has considerably improved. They are kept more cleanly than formerly, on account of the vigilance of the Board. I have made several complaints requiring a proper grading, the construction of drains in yards, the proper construction of areas with drains sufficiently trapped, also the covering of surface-drains; and when a sewer in the street existed, the connection with it and the different drains. Hence, the relief which the tenement-house law gives and exacts. Instead of yards, areas, courts, and alleys, being continually damp by an overflow of slops, waste-water, etc., these evils have been greatly diminished by exertions of the Board.

Neglect of Privies and Stables.—The houses being large, and the number of inhabitants great, the small privy-vaults, which are generally shared by two houses, are rapidly filled, on the slightest obstruction, to the small six-inch drains, causing very offensive and pestilential odors to enter the apartments, particularly where there are rear houses, the distance from front to rear seldom being more than twenty-four feet, and oftener less. The privy-house is always situated in the middle of the yard, and is generally about eight feet long, thus leaving a distance of eight feet between each house and the privy-vault. The consequence is, there is a continual odor in the apartments during the hot months. I have complained of over one hundred and forty, the Board acting very promptly and energetically in causing the speedy cleansing and disinfecting of these pestiferous holes, and when not connected with the street-sewer, or when not properly flushed, there was a very short delay in having it done.

The stables are in a better condition since the attention of the Board has been called to them, and there is a greater regard for cleanliness displayed, and a better management in the removal of manure. The yards now, as a general thing, are properly graded, the stables have tight manure-vaults or covered boxes with sewer connection, and are properly drained and cemented. Altogether, the stables in my district are not so numerous as to be called a general evil.

Streets and Gutters.—Nearly all the streets in this district are paved with cobble-stones, very irregularly set, and poorly graded. The consequence is, the trouble or inability of the street contractor to thoroughly clean them. The streets were pretty regularly swept, nearly as often as the contract called for, but this does not come up to a proper sanitary standard, as some of the streets required cleaning every day during the summer months, for the reason that slops and garbage were constantly thrown into them, the stench arising from the decomposition or fermentation being almost intolerable. Third, Fourth, Fifth, and Sixth Streets, east of the First Avenue, Chrystie, Ludlow, Avenue B, and Clinton, deserve mention as the dirtiest streets in this district; several of these streets were cleaned and disinfected at the expense of the Board, as the street contractor did not care to do more than was required of him by law. In my opinion, there will not be a thorough cleaning or proper sanitary condition of streets unless there is some supervision over them by the Board of Health.

Where the streets are properly graded, the gutters are generally in the same condition, but this is such a rare sight in the Sixth District that, where there is a regular grade, the public may, in nearly all cases, be grateful to the Board of Health for being the prime movers in it. The gutters, when not in good repair, or not properly graded, form receptacles for garbage and filth, obstructing them and making the fluid overflow into the streets, or settle and stagnate in them. These gutters were also attended to by the Board, and by prompt disinfection, purification, and cleaning, I am satisfied the mortality was considerably reduced.

Ashes and Garbage.—There is a great necessity for a more efficient removal and care of ashes and garbage in this district; although the "ashman" makes his rounds every day, yet there is no stated hour for him to make his visits. The consequence is, the people place their ashes and garbage in small vessels on the edge of the side-walk, where they remain several hours overflowing, the contents to be scattered around promiscuously by the rag-pickers, or upset accidentally or by malicious boys into the street-gutters. There is a considerable number of small groceries or places where vegetables are sold, and these vegetables, when a little old or unsalable, are thrown or swept into the streets, where they lie two or three days, and often longer, until the streets are cleaned. In nearly all the streets in the Sixth Sanitary District, the above-described condition exists, and hence the great need of a suitable receptacle for ashes and garbage, and also the supervision of it by the Board of Health.

Offensive Animal Refuse, Fat-Boiling, etc.—There are very few places where fats are boiled in this district, or where animal refuse is stored, and these are conducted in such a manner that there is nothing offensive or detrimental to health in them, the Board refusing to grant a permit, prosecuting the offenders when not conducted according to sanitary principles.

The chief sanitary improvements in this district are the removal of the slaughter-houses and offensive animal refuse, the increased amount of ventilation of tenement-houses, the vacation of all damp and unhealthy cellars, the better condition of the stables, and the sewer connections of filthy privies, yards, areas, and leaders, the regrading of gutters, the disinfecting and cleaning of the privies and streets, and the construction of water-closets when practicable in preference to privies.

There is yet, in my opinion, an improvement which is badly needed in tenement-houses, and that is, the construction of baths for the occupants on each floor, or to a certain number of families residing therein. The proposed introduction of salt-water would be very advantageous for this purpose, as also for the flushing of streets and privies, the system at present employed being almost entirely insufficient, as there is not an adequate body of water to carry off the filth in the privies, streets, and sewers. I also recommend the construction of water-closets where the ground is low, as the foul and noxious gases from the street sewer cannot enter them as easily as they do the privy-drain, the water-closet pipes being properly trapped, and having a better descent into the street sewer than the privy-drain. I would also suggest that a law be passed preventing the construction of more than one house on a lot (tenement), and that not to occupy the entire depth of it, so that a greater air-space may intervene between them; and also a law preventing the occupation of cellars for dwelling purposes.

In this thickly-populated district there are eight streets unsewered, viz.: Clinton Street, from Rivington to Houston Street; Avenue B, from Houston to Sixth Street; Norfolk Street, from Stanton to Rivington Street; First Avenue, from Houston to Sixth Street; Second Avenue, from Houston to Third Street; Avenue A, from Second to Fourth Street; Avenue

A, from Fifth to Sixth Street; Eldridge Street, half block between Houston and Stanton Street. This, I think, should be speedily remedied, as every one is now aware of the beneficial results of proper drainage. There ought also, in my opinion, to be an improvement in the construction of sewers. Instead of sharp edges or angles at their intersections, they ought to be more rounded, as that would allow the refuse matter to flow more freely. The construction of the culverts also ought to be different. Instead of placing them on the corners of the streets, opposite the crosswalks, I think it would be more beneficial to health to place them a short distance from them, as there is a greater number of persons crossing at the intersection and crossing the culverts, thereby inhaling whatever noxious gases may arise from them. The streets also ought to have a more even surfaced pavement than cobblestones, as that would greatly help their more effectual cleaning.

Consolidated statistics of inspectional labor (exclusive of the Tenement-House survey):

Tenement-house inspections	667
Private " "	212
Stable "	67
Cellar "	153
Yards, areas, etc. "	430
Privy-vault "	441
Drains, etc. "	38
Orders by the Board	43
Total inspections	2,051
Reinspections tenement-houses	682
" private "	18
" stables	12
" cellars	90
" yards, areas, etc.	103
" privy-vaults	104
" drains, etc.	10
Total reinspections	1,019

I have the honor to submit the following statistics of the "Sanitary Survey" of the Sixth District, bounded by the south side of Sixth Street, north side of Rivington, west side of Clinton Street and Avenue B, and the east side of the Bowery. It contains:

Tenement-houses	1,166
Number of families in tenement-houses	11,644
Population of tenement-houses	45,410
Average number of families in tenement-houses	9.9862
" " " persons to each family	3.90
Private houses	1,055
Stables	116
Manufactories	48
Shops (work)	86
Churches	11
Schools (two of which are public, one free German, the balance parochial or private)	8
Convents	2
Cemeteries	3
Hospitals for cripples	1
Dispensary (German)	1
Breweries	4
Pork-packing and lard establishments	6
Vacant lots	3
Fire-engine Company	1

Police-station	1
Hide-melting Association	1
Theatrical Scenery Depot	1
District Court	1

Respectfully submitted,

JOHN T. NAGLE, M. D.,
Sanitary Inspector.

NEW YORK, *January* 1, 1869.

DISTRICT No. 7.

Dr. ELISHA HARRIS, *Sanitary Superintendent.*

SIR: I have the honor to present this report of inspectorial labor in the Seventh Sanitary District, extending over a period of nine months, viz., from January 20, 1869, to October 20, 1869.

The Seventh District is bounded north, by East Fourteenth Street; east, by Avenue B; south, by Sixth Street; west, by Fourth Avenue; being the northern half of the 17th Ward.

There is no portion of the district which is extensively occupied for commerce or wholesale trade. There are but few manufactories of any importance, and these are scattered in various localities. Almost the entire district is occupied for dwelling purposes and petty trades. The section lying between Second Avenue and Avenue B contains fully four-fifths (⅘) of all the tenement-houses; while the portion included by Second and Fourth Avenues is almost exclusively filled with private dwellings, churches, and public buildings. All the avenues, with the exception of Second Avenue, contain more or less tenement-houses; First Avenue and Avenue A, however, far exceeding Third and Fourth Avenues in the number and importance of this class of dwellings. The nationalities of the different sections are various. In the northeastern portions the Irish predominate. In the central, southern, and southeastern parts, there is more of the German element. Among the better class of dwellings, i. e., west of Second Avenue, especially in the side streets, the population is principally American; but in no locality is the nationality entirely distinctive. Even in particular tenement-houses I occasionally find Irish, Germans, and Americans, although this is by no means frequent.

The highest altitude in the district is at the corner of Fourteenth Street and Fourth Avenue, being forty-one feet above tide-water; the lowest point is at the corner of Fourteenth Street and Avenue B, being nine feet above tide-water. The western portions are generally higher than the eastern, the land sloping from west to east. The direction of the principal sewers is from west to east, all of them finally emptying into the East River. The fact of the peculiar slope of the land bears a very important relation to the condition of the soil as respects dampness. Thus, in the western portions, the cellars are generally dry, while in the eastern sections dampness is the rule. This is especially noticeable in particular sections, which are influenced by still other natural causes. For instance, in Fourteenth and Thirteenth Streets, between First Avenue and Avenue A, where there was originally a pond of several feet in depth, fed by a living stream, the cellars and cellar-basements are, almost without exception, constantly damp and unhealthful. The pond has been filled in, and the water-course averted from its bed into the sewers, as far as practicable, but the springy nature of the soil still exists. The site of the pond is almost entirely covered by Read's brewery in Fourteenth Street, near First Avenue, but the land through which the stream flowed is occupied by populous tenement-houses. Another extensive water-course flowed through the extreme eastern portion of the district, between Ninth and Sixth Streets, and in the neighborhood of Avenue B. Many of the cellars in this section are constantly damp.

During the period to which this report refers, I have made the following number of inspections and reinspections, which I tabulate and classify as below:

Tenement-houses	1,497	Vacant lots	8
Private dwellings	186	Sewers, drains, etc.	26
Stables	144	Public buildings	12
Privy-vaults and water-closets (special)	223	Public schools	11
Stores and manufactories	55	Breweries and distilleries	18
Fat-boiling, lard-rendering, etc.	48	Slaughter-houses	3
Cellars and basements (special)	225	Rag-storing warehouses	6
Yards, courts, and areas	262	Guano-manufactory	1

Total......2,725.

The following table exhibits the consolidated statistics of the "Tenement-House Survey:"

Total number of tenement-houses surveyed	397
" " families residing in above	3,701
" " persons " "	16,654
Average number of families in a house	9
" " persons	40
Largest " families	23
" " persons	104
Total number of tenement-houses with water-closets	8
" " " " " privies	389
" " " " " sewer connected	390

The following table shows the number of tenement-houses which have been in violation of the different sections of the "Tenement-house Law:"

Violating Section 2	281
" " 3	305
" " 4	27
" " 5	99
" " 6	32
" " 7	46
" " 8	397
" " 9	342

In remarking upon the results of experience in applying the improvements required under the "Tenement-house Law," I beg leave to consider each of the various sections in numerical order, as follows:

SEC. 2. *Ventilation.*—I premise by stating that, by the closest calculation in my power, I have found, in the 397 tenement-houses inspected with reference to the "Sanitary Survey," the average amount of air-space per occupant to be about 195 cubic feet in the sleeping-rooms, and about 325 cubic feet in the dwelling-rooms. With this small amount of air-space to live and breathe in, it is readily seen how important must be the necessity for constantly renewing and keeping in motion the interior atmosphere of these houses, and for affording a proper means of outlet for the foul air. This result is only to be attained by perfecting their ventilation. Experience has taught me that this is the most difficult of all the sections of the law with which to induce tenement-house owners to comply. Very few of the houses in my district altogether comply with Section 2. Improvement, however, is steadily taking place. There is not one of the above number of houses in which some alteration or addition has not taken place in this respect. By far the most frequent variety of hall-ventilators is what is commonly known as the "bulkhead," consisting of a wooden-box or frame-work in the roof at the top of the hall, with a door at one extremity, in many instances having access thereto by means of stairs, thereby combining the office of a fire-escape with that of a ventilator. In other cases I find the bulkhead inserted in the roof, with no means of approach, with a lattice surrounding its base in place of the door. This, however, is a comparatively rare form. In many of the smaller houses the ventilator consists of a lattice surrounding the combing of the skylight. The door in the extremity of the bulkhead is frequently found to be solid, and in such cases there are no means of ventilation when the door is closed. It has been my custom to recommend that a window or lattice should be made in these doors, to insure constant ventilation. Still another variety of roof-ventilators is the upright, hollow, metallic cylinder inserted in the roof, having a revolving flue at the upper extremity. I do not know of more than five or six of these in the entire district. The halls of the rear houses are most frequently ventilated by means of windows in the rear walls, and occasionally in the front walls of each story, or by a lattice surrounding the base of the skylight in the roof. I find more negligence in respect to the ventilation of bedrooms than to that of halls. There are, it is true, very few bedrooms entirely without ventilation; but tenement-house owners are, as a rule, either unable or unwilling to appreciate the necessity for the cross-current attained by means of two windows constructed in different planes. The chief objection is raised with respect to the windows communicating with the halls. The owners and occupants represent that these windows afford a ready access to thieves, and also that they seriously interfere with privacy. The former objection is obviated by securely barring the windows, and the latter by constructing them at a sufficient height and covering the openings with curtains. In many of the rear houses the letter of the law is complied with, while the spirit is evaded, in the ventilation of the sleeping-rooms. I refer to those rear houses whose walls approach to within an inch or two the walls of adjacent houses, and where the space between these two walls is practically nothing. Windows are cut in the rear walls, and make the sleeping-rooms "communicate directly with the external air," while to all practical purposes there is no ventilation whatsoever. There is apparently no remedy for this evasion under the present reading of the law. In a few instances the sleeping-rooms communicate with the external air by large windows with sashes and blinds, in the same manner as the living-rooms. In other cases, and these not a few, I find perpendicular ventilating-shafts between adjacent houses, extending from roof to cellar, either open at the top, or covered with flues, or surrounded at the upper extremity with a lattice. From each sleeping-room there is communication with these shafts by means of apertures, windows, or flues, varying in diameter from three inches to two feet. This method of ventilation I consider the most desirable of all. The chief objection to it is the frequent tendency of the occupants to stop the holes of communication with rags and other materials in cold weather, thereby shutting off all ventilation. In East Twelfth Street, between First and Second Avenues, there is a row of eight large tenement-houses, each of which is ventilated in this manner. Between every two adjacent houses in this row there is an open space of several feet in diameter, covered at the top with a skylight, and with this space every sleeping and dwelling room in both houses communicates by means of large windows. These houses are the most thoroughly ventilated tenements in my district.

SEC. 3. *Fire-Escapes.*—During the past year the control and management of fire-escapes have been exclusively referred to the Superintendent of Buildings, and the Board of Health has not attempted the enforcement of Section 3. I simply refer to the fact that, in the 397 tenement-houses surveyed, 305 were destitute of fire-escapes.

SEC. 4. *Roof-drainage—Stairs.*—Roof-leakage is a comparatively rare occurrence, much rarer than I had expected to find it. This is probably due to the fact, that the discomfort produced among tenants by dampness is felt immediately and severely by them, inducing them to seek relief from the landlords without the intervention of the Inspector. The leaders from the roof discharge their contents in two ways, viz., into the street gutter, by pouring into an open or covered gulley in the sidewalk, or into the privy-vault in the yard. The latter disposition I always advise, as it materially assists in the flushing of the vault. Stairs and banisters are generally kept in fair condition, although I have found a few instances to the contrary.

SEC. 5. *Water-closets and Privies.*—The neglect, and consequent foul condition, of water-closets and privies is by far the most frequent, and, at the same time, one of the most dangerous violations of the "Tenement-house Law." Water-closets are the exception in my district, only eight out of three hundred and ninety-seven houses surveyed being furnished with them, and in these eight houses I should prefer the substitution of the ordinary privy vault. The water-closet, whatever may be its superiority in a private dwelling, is invariably a nuisance in a populous tenement-house. The almost uniform carelessness of the occupants, with respect to using the water for flushing the closet, frequently leads to obstruction of the sewer-pipe, and consequent filling of the hopper with fecal matter: and, when such is the condition of the water-closet, the floor and seat are used instead of the hopper. I have seen the hopper literally filled with excrement and urine, which overflowed in streams upon the floor. Again, the means of flushing are much more complicated than in the case of the privy vault; and when the supply pipe, or waste pipe, as the case may be, fails to afford the necessary water, obstruction and filling of the basin are almost inevitable. It would be a very simple matter, in my opinion, to keep the privy vault unfilled and the sewer-connection unobstructed, with any thing like decent care on the part of the tenants. But the vault is too frequently made the receptacle for ashes, garbage, old boots, tin pans, and animal, vegetable, and mineral matter of every description. In many instances I have found the privy vault full almost to the top with offensive matter (owing to the obstruction of the sewer pipe by some of the above-named substances), when I have felt for the orifice of the pipe with a pole, and in a very short time relieved the difficulty by pushing away the obstruction, and flushing the vault by means of the yard hydrant. And yet, simple as the remedy is, I have hardly ever known a tenant to take the trouble to use it. The obstructing substance is suffered to find its way into the sewer pipe; and, when the condition becomes unbearable, the landlord is obliged to dig down upon the pipe and remove the cause of obstruction. The connection of tenement-houses with the sewer is now almost general in the Seventh District. I have thus far found only seven houses entirely unconnected. But many have a very imperfect connection, the sewer-pipe being small and fragile, and liable to frequent obstruction and leakage. In some sections several adjoining premises are connected by small separate pipes with a larger common drain, which empties directly into the street sewer. This condition is always objectionable, for in such cases obstruction of the common drain causes filling of all the privy-vaults with which it is connected. Privy-vaults are flushed in three ways: 1st, by the hydrant in the yard; 2d, by the leader from the roof; 3d, by surface water from the yard. In many cases these various methods are employed together. If only one were to be used, I should prefer the hydrant-flushing, as it can be available at all times. Water from the roof and surface of the yard is only obtainable in rainy or snowy weather. I have found all the privy vaults in entire streets full at the same time, owing to obstruction of the street sewer. But this point I shall refer to under the head of street sewerage. A great improvement has taken place during the past year in the grading of yards. Many yards, which I found in the early spring irregularly graded, and constantly filled with mud and stagnant water, have been leveled and paved throughout their entire extent, and are now always dry and clean.

SECS. 6 and 7. *Cellar-habitation.*—There are at present, in the Seventh District, upward of one hundred and fifty cellar-basements occupied as dwellings. The majority of these are in fair sanitary condition; many complying with the law in every respect; some even exceeding the legal requirements in the matter of ventilation; others not altogether conforming to the technical points of the law, but sufficiently so for health. I do not know of any cellar totally unfit for habitation which is at present occupied. About thirty-five permits for cellar habitation have been issued by the Board.

SEC. 8. *Dangerous Storage.*—There are no tenement-houses, as far as I am aware, where combustible or dangerous articles are kept, except in four or five instances, where rags are stored in basements. These rag-storing basements are, unquestionably, exceedingly dangerous to the health and lives of their respective localities. In every instance the rags are of a mixed character, many of them being what are known as "street rags," dirty, foul, and offensive in the extreme. They are gathered from every portion of the city, and in every conceivable degree of cleanliness and filth. Some of them are taken from beds of contagion and death, some from streets and gutters reeking with animal and vegetable refuse. They are packed tightly in bales, after sorting, the clean separated from the foul, and remain for months together in damp, close, and ill-ventilated cellars, often emitting a peculiarly offensive and stifling odor. In one instance I have clearly traced the origin of a formidable epidemic of typhus fever to one of these rag-storing basements. I consider their existence in the closely-packed tenement sections as necessarily a terrible exposure of the inhabitants to the inception of disease, and earnestly recommend their unconditional abolishment. I know of only two tenement-houses in which horses are kept, and these have small stables in the cellars, in which one and two horses respectively are kept. In a few instances I find the smaller animals in cellars, but in no case is their keeping detrimental to health. (I reserve the consideration of garbage-vessels for discussion in another place.)

SEC. 9. *Cleanliness and Whitewashing—Posting of Names.*—A marked improvement has taken place in the general cleanliness of formerly filthy tenement-houses. This has partly been brought about by persuasion and advice among the tenants, but chiefly through the stringency of the Board in enforcing this clause of Section 9. Many walls and ceilings are now whitewashed or painted at proper intervals, which formerly were totally neglected. There has been very little change for the better in the matter of posting owners' and agents' names. The Inspector respectfully begs leave to urge the enforcement of this posting as a matter of great economy of time. Many hours and days of inspectorial labor are lost to the Board through the negligence of the owners in this respect.

SEC. 10. *Access to Officers.*—I have found in no instance the slightest difficulty in effecting an entrance to any tenement-house or room for any official purpose. Owners have been extremely negligent in reporting cases of sickness, probably through fear of the friends of the sick. A very good disposition has been shown toward disinfection, fumigation, and destruction of clothing, bedding, etc., in cases of contagious disease.

SECS. 11, 12, 13, 14, 15, 16, 17, 19.—I pass by the consideration of these sections. In reference to Sections 12, 13, 14, and 15, I would say that no new tenement-houses have been built in the Seventh District during the past nine months.

SEC. 18. *Modifications.*—The Board has, in many instances, modified the requirements of the foregoing sections, where such modification seemed expedient.

I respectfully present the following remarks upon certain points of sanitary interest:

Stables.—There are very few large stables in the district, the largest containing ten or twelve horses. There are numerous smaller ones, with one or two horses in each, scattered in every section. Many of these smaller stables are in the yards of tenement-houses, the exit for the horse being through the hall of the house, or through an alley-way at the side of the house. I find the smaller stables more frequent sources of filth and permanent uncleanliness than the larger ones. This is due to the fact that the latter are usually supplied with proper manure-vaults and sewer-drains; while the former, from their supposed insignificance, are expected to escape the eye of the Inspector, and, in the majority of instances, are surrounded with filth and manure. In upward of twenty stables the Board has compelled the construction of adequate manure-boxes and vaults during the past year, and the cleansing and disinfecting of the stable-yards. In general, I should prefer the water-tight covered manure-vault for stables containing upward of four or five horses; while the wooden or metallic box, resting upon the surface of the yard, seems to prove more desirable for the smaller ones. But, in any case, I regard a stable as a nuisance upon tenement-house premises.

Fat-boiling; Lard-melting; Tallow-rendering.—I know of only one establishment where fat is boiled in any considerable quantity. I refer to a large pork-packing house on the corner of Thirteenth Street and Avenue A. In this establishment the method of boiling by steam is employed, the steam being introduced by pipes into a large tank filled with the pork-clippings and fat, the tank being covered by a nominally steam-tight lid. No condenser is used. The inmates of the surrounding tenement-houses complain frequently and bitterly of the offensive odors proceeding from this house. I have seen the foul steam from the tank issuing from either side of the imperfectly steam-tight cover, thence freely ascending through the roof, and contaminating the surrounding atmosphere. Almost every butcher-shop in the district has a small open kettle in the rear of the store, or in the cellar, in which fresh lard or beef-tallow is rendered. I do not believe, however, that any of these small rendering-establishments are productive of serious nuisance.

Garbage—Condition of Streets.—The proper means of disposing of the garbage and general refuse matter of tenement-houses is the most perplexing of all the sanitary problems with which the Inspector has to deal. Every variety of garbage-boxes, and every degree of caution and care in the use of the various vessels employed, have been recommended and tried in the district. As yet the result of experience has proved very unsatisfactory. I do not know of any block in the entire tenement-house portion of the district where the street is not at one time or another defiled with these refuse materials. In some sections the streets and gutters are never free from garbage. The large uncovered garbage-boxes upon the sidewalks, which were formerly in such general use, and productive of so much offensiveness by reason of the concentration of filth which they induced, are now almost altogether done away with. I find a few houses where barrels or boxes are kept in the yards or cellars, for the general use of all the tenants. But by far the most frequent method is that which obliges each family to see to the removal of its own ashes and garbage from its rooms to the sidewalk. In the vast majority of houses each family keeps one or more small garbage-pails or pans in its rooms or closets, and each morning places these vessels upon the sidewalk at the edge of the street-gutter, for subsequent removal by the garbage-cart. The practical working of this method is attended by less evil than that of the larger garbage-boxes shared in common by all the tenants. It is open to this objection, however, that the tenants are compelled to live and sleep in an atmosphere tainted with garbage. In this connection it seems proper to refer briefly to the condition of streets. An immense improvement has taken place in the worst portions of the district since February last. Streets which, up to that time, were constantly reeking with every variety of decomposing animal and vegetable matter, have been regularly cleaned, and, in many instances, thoroughly disinfected. For example, in East Eleventh Street and Thirteenth Street, between First Avenue and Avenue B, I have found, by actual measurement, solid masses of compacted rubbish, ashes, garbage, and the most offensive forms of street-filth, three or four feet in height, and from twenty to forty feet in length. These immense centres of filth have all been removed; and, although far from being thoroughly clean, the condition of all these streets is vastly improved. As a rule, I believe that all the garbage and street-filth have been faithfully removed as frequently as the law requires. But the wilful carelessness of the tenement-house occupants renders it practically impossible to keep the streets in perfect sanitary condition.

Local Superintendence in Tenement-Houses.—It will be noticed that, in speaking of the various evils attendant upon violations of certain sections of the "Tenement-house Law," and in referring to the condition of the streets, I have alluded to the careless habits and indifference of the tenants as influencing in no small degree the sanitary condition of the tenement-house sections. I do not believe that any thing approaching perfection in sanitary reform can be attained under the present management of tenement-houses. The sanitary laws are sufficiently broad, and cover almost every conceivable point, and their enforcement is generally stringent to the last degree. And yet, with all this, there is something essentially wanting. The first need lies in the direction of modelling the premises to conformity with the law. This is effected by rigidly enforcing the "Tenement-house Act." Then follows the necessity of modelling the tenants to compliance with the various requirements of decency and cleanliness. This can only be done by constant watchfulness and personal supervision. The Sanitary Superintendent is well aware how urgent is the necessity for this local superintendence in the individual tenement-houses. Most, if not all, of the many evils resulting from the neglect of privies and water-closets; the filthy condition of cellars, yards, and dwelling-rooms; the storage of dangerous articles; the carelessness in the disposition of garbage and ashes; and the host of minor nuisances occasioned by ignorance, wilfulness, and malice on the part of the tenants, are readily averted by proper surveillance on the part of some competent person invested with the necessary power to control these evils. The experiment has been tried in many houses, and has invariably proved a success. I need only refer to a recent report in the hands of the Sanitary Superintendent upon the subject of this local supervision.

Sewerage.—The condition of the street-sewers has been generally good. One marked exception is the case of the Seventh Street sewer, which, during the past two or three months, has been extensively obstructed, and has leaked freely at various points. This condition has caused filling of all the privy-vaults in Seventh Street, between Avenues A and B, and flooding of the cellars of many of the tenement-houses in this street. The sewer is, however, being thoroughly repaired, and in many portions entirely rebuilt. No new sewers have been made in the Seventh District during the past year, although there are many streets where the absence of sewers is seriously felt.

The following is a list of streets at present unsewered:

Fourth Avenue, between Thirteenth and Twelfth Streets, Eleventh and Tenth Streets, Ninth and Seventh Streets; *Third Avenue*, between Twelfth and Tenth Streets, Ninth and Eighth Streets, Seventh and Sixth Streets; *Second Avenue*, between Tenth and Eighth Streets; *First Avenue*, between Fourteenth and Thirteenth Streets, Tenth and Ninth Streets, Eighth and Seventh Streets; *Avenue A*, between Twelfth and Tenth Streets, Eighth and Sixth Streets; *Avenue B*, between Thirteenth and Twelfth Streets, Tenth and Seventh Streets; *Twelfth Street*, between Second and Third Avenues; *Stuyvesant Street* throughout its whole length.

Contagious Diseases.—About the 25th of December, 1868, a somewhat remarkable local epidemic of typhus fever broke out in the upper portion of the district. The origin and history of the epidemic have been detailed in a special report to the Sanitary Superintendent. The disease was peculiar in its character, in some respects resembling typhoid, and in others typhus fever, the typhus symptoms predominating. Prompt and efficient measures were at once employed by the Board for its extermination. Patients were removed to hospitals. Three streets, from Second Avenue to the East River, were thoroughly cleaned. All the street-gutters, yards, privy-vaults, and cellars, were cleansed and disinfected. Clothing, bedding, and furniture, were in numerous cases destroyed, and many tenement-houses in the infected district were fumigated and whitewashed. The contagion gradually subsided (the last case being found on the 23d of March, 1869), after having run a course, more or less virulent at different times, of about three months. The following table exhibits the number of cases, mortality, etc.:

Number of cases	29
Sent to hospital (and lost sight of)	5
Deaths at home	9
Recoveries (of which I am aware)	15

Small-Pox.—I have visited in all thirty-five cases of small-pox and varioloid since the 5th of February, 1869, the last case occurring in the early part of July, 1869. The chief virulence of the disease showed itself during the months of May, June, and July, 1869, thirty-one out of the thirty-five cases occurring in these months. There were four deaths and thirty-one recoveries, making the mortality percentage a fraction above eleven. Removal to hospital was generally advised, and in some cases compelled. I found an almost invariable unwillingness on the part of patients and their friends to submit to such removal. Vaccination was freely employed in the infected houses and neighborhood. The following is a table of cases:

February, 3; March, 1; April, 0; May, 12; June, 11; July, 8.

No fresh cases have come under my observation.

Vaccination.—On the 24th of May, 1869, the Board instituted the work of general vaccination throughout the various districts by house-to-house visitation. At first, both private dwellings and tenement-houses were indiscriminately visited. But in a short time, owing to the magnitude of the undertaking, we were instructed to pass by the former, and to confine our efforts exclusively to the tenement-houses. I found a very favorable disposition shown by the people generally, meeting with almost unqualified encouragement. The objections were few, and in every case unfounded. Out of the large number vaccinated, I know of but four cases which resulted at all unfavorably, in each of these there being severe erysipelas, all of them finally recovering perfectly. Drs. G. Wynkoop, W. De F. Day, G. H. Butler, and J. T. Kennedy, were detailed to aid me in my work, and rendered much faithful and valuable assistance during the entire month of June, with the exception of Dr. Day, who resigned June 15, 1869. Among the public schools the work was conducted with most thorough and complete success, the Board of Education and the local Board of Trustees heartily coöperating with the Inspector throughout. I cannot refrain from mentioning the extreme cordiality and good-will evinced by the teachers in all the schools, their **cheerful** efforts and kindly advice to the scholars and parents overcoming multitudes of **objections**, and making the work in their midst successful far beyond my anticipation.

I refer to the following schedule of labor performed by the Inspector and his **assistants**:

NAME.	Number of families visited.	Number of primary vaccinations in houses.	Number of revaccinations in houses.	Number of primary vaccinations in schools.	Number of revaccinations in schools.	Total number of primary and re-vaccinations in houses and schools.
G. H. Wynkoop..	1,250	104	88	...	....	192
W. De F. Day....	1,112	33	31	...	....	64
J. T. Kennedy...	1,861	131	172	...	....	303
G. H. Butler.....	1,362	141	74	...	....	215
W. H. B. Post...	1,486	159	124	172	1,399	1,854
Total.........	7,071	568	489	172	1,399	2,628

Total number of tenement-houses (front)	655
" " " " (rear)	130—783
" " " families in tenement-houses	7,162
" " " persons " "	32,229
Average number of families to a tenement-house	9+
" " " persons "	40+
Largest number of families in a tenement-house	24
" " " persons "	106
Average cubic space in living-rooms	370 feet.
" " " " sleeping-rooms	220 "
Largest cubic space in living-rooms	1,740 "
" " " " sleeping-rooms	980 "
Smallest cubic space in living-rooms	175 "
" " " " sleeping-rooms	100 "
Total number of tenement-houses with privies	734
" " " " " water-closets	31
" " " " " sewer connected	776
" " " " not with sewer connected	9

All of which is respectfully submitted.

W. H. B. POST, M. D.,
Sanitary Inspector Seventh Inspection District.

DISTRICT No. 8.

Elisha Harris, M. D., *Sanitary Superintendent.*

Sir: In submitting this report, I beg to state that my service on the staff of **Sanitary** Inspectors for the short period of two months has been hardly long enough to **enable** me to become acquainted with the wants and improvements of the whole district. **The** portion which I have personally surveyed and inspected, I am fully conversant with; **but** the larger portion, which was surveyed by my predecessor, and the remainder not **yet** inspected, are unknown to me in respect to their internal conditions—population, cleanliness, ventilation, etc., except, perhaps, in a few cases where I have been directed to make **reinspections**. I would, therefore, ask your indulgence for any shortcomings on my part, **or** should my judgment vary somewhat from that of my colleagues who have been longer in **the** service and have the advantage of experience, and consequently a broader field of **observation**. The duties with which a Sanitary Inspector is tasked are so various that it requires a certain time and some considerable amount of experience to view matters in the right light and to pass proper judgment upon them.

The district, the Eighth (Eleventh Ward), assigned to me, is bounded north, by Sixth Street; south, by Rivington Street; west, by Avenue B and Clinton Street; and east, by the East River. The greater portion of the district is reclaimed land. The entire portion above Houston Street was formerly occupied by salt-water marshes, except a part of Avenues B and C and Second and Third Streets, which was slightly elevated. A small creek, taking its rise at or near Avenue C and Second Street, ran easterly a little below Avenue D, then changing its course toward the north, proceeded up as far as Fourth Street, whence it flowed in a northeasterly direction and emptied into the East River at the foot of Fifth Street. The greater part of Lewis and the whole of Goerck, Mangin, Manhattan, and Tompkins Streets were under water, and are entirely new-made land. All the streets below Houston, except Goerck, Mangin, and Tompkins, were laid out upon the natural land.

The northwestern corner of Sixth Street and Avenue B is twelve feet above tide-water mark; the altitude rises from this point to Houston Street, four feet; Lewis Street, which is the fourth street from the river and was formerly the old water-front, at present is only eight feet above tide-water mark. The highest point is at the southwestern corner of Clinton and Rivington Streets, which is a little more than twenty feet. The average grade of the portion north of Houston Street is only nine or ten feet above tide-water mark. The streets running in a northerly and easterly direction form more or less regular squares; Houston Street, however, by intersecting Second Street, forms two irregular blocks between Avenues B and C and Avenues C and D, the latter being occupied by the Union Market and the Eleventh Precinct Police Station.

The whole district contains forty-three regular and irregular squares. Many of these squares are wholly or in part insalubrious, on account of the soil, overcrowding of domiciles, defective ventilation of sleeping-rooms, neglect of domestic cleanliness, insufficient supply of water, deficient house and street sewerage, obstructed waste and sewer-pipes, leaky roofs, disposal of the slops and garbage on the sidewalks and in the street gutters in front of tenement-houses, filthy privies, foul cellars, dirty and badly-drained courtyards, and the presence of a number of old dilapidated wooden shanties used for stalling horses and other domestic animals. In consequence of the frequent want of proper manure vaults or bins, the manure is thrown into the yard, or even on the roofs of the miserable shanties, in order to protect them in the winter from the cold, thus spreading pestilence around the neighborhood.

Between Avenues B and C, in Second Street, there are six building lots belonging to one of the oldest estates in the city, which are occupied by six old and dilapidated houses. The yards are occupied by a number of wooden shanties, and in the extreme rear is a row of miserable huts used for stables, no less than forty horses being kept there. The alley leading to these stables is not more than three feet wide, and is very filthy. The drainage is bad, allowing the rain-water together with the horse-urine to soak into the ground, and at last to find an outlet through the walls into the adjoining cellars of the rear houses in Third Street, making them, of course, very unhealthy. There is no connection with the sewer of the street; there appear to have been drains at a previous period connected with the privies in the yards, but they have been long since filled up with dirt. There are no vaults or proper bins for the reception of manure. To what extent this combined nuisance influences the health of the neighboring population I am as yet unable to judge, but, I have no doubt, it must be great, particularly in respect to zymotic diseases, as the square is one of the most crowded in the district, more than 2,500 people living there.

If we divide the district into two portions by Houston Street and examine each section separately in regard to its insalubrity, we find that the portion below Houston Street is the more unhealthy. The recent small-pox epidemic found here a ready and fruitful field to thrive and grow upon, and had it not been for the prompt action of the Board of Health in having every person that was in danger of infection vaccinated, keeping a strict supervision over the unfortunate creatures who had already become infected with the disease, and disinfecting all their domiciles and bedding wherever the pest showed itself, the suffering and death-rate might have been immense. When I was occupied in surveying the portion above Houston Street, it was almost an exception to find a person sick in bed; but below, I enter scarcely a house in which I do not meet with some kind of sickness, and typhoid fever has already begun to show itself among the unfortunate people of this locality. The causes of this are apparent and are easily told. The houses are old and overcrowded. There is a tenement-house in Clinton Street with a population of 112 souls; another in Attorney Street in which 118 people are packed together, and the whole square in which these two houses are located, containing thirty-five tenement-houses, gives habitation to not less than 1,580 people, averaging to each house 43⅔ souls; while the houses in the most densely-crowded square in the portion above Houston Street have an average population of only 36½ people to each house. The great number of cellars still inhabited; the indoor occupation of these people, most of them being tailors, shoemakers, cigar-makers, etc., their filthy domestic habits, and the bad and ill-nourishing food they eat; the badly-ventilated sleeping-rooms and the small allotment of air-space to each person (being, in many cases, in living and sleeping room together, considerably less than 200 cubic feet); the filthy privies and streets; the number of stables which are invariably kept in a filthy condition, and the neglect of manure, which sometimes is even thrown into the street to remain for hours before it is removed to the dumping-ground; all these unhealthy combinations are in themselves sufficient to develop the various germs of disease.

It is in these particulars that my district most needs improvement and reform, and, if there be humanity in those who have the power to alleviate the wretched condition of these people, let me conjure them to lose no time, for many lives are in danger. The Board of Health is ever watchful and is ever endeavoring to guard the public health, and to alleviate the wretched and suffering condition of these poor people. Indeed, this Board has been a blessing to the city of New York, and merits the commendation of the community for the improvements it has caused to be made in regard to tenement-house ventilation, the removal of the offensive slaughter-houses from the heart of the city, the evacuation of many uninhabitable cellars, the eradication of local, and the alleviation of general nuisances; and thus, as it were, averting the epidemics which at various times have threatened us with an invasion.

The survey of the portion of the district which is located above Houston Street, together with the square bounded by Houston, Rivington, Clinton, and Attorney Streets, has been completed, partly by my predecessor, partly by myself. The streets which are almost exclusively occupied by tenement-houses are Second, Third, Fourth, Fifth, and Sixth Streets, between Avenues B and C and Clinton and Attorney Streets. In all the other streets private houses predominate; this, however, will be best understood by the consolidated report of the survey thus far completed, which is given hereafter. The Avenues, B, C, and D, are occupied, to a considerable extent, for business purposes of various kinds. The squares which are located on the water-side are used for lumber, ship, and coal yards, and there are but few buildings which are inhabited as dwellings, except on the block between Third and Fourth Streets, which is occupied by about 150 people, mostly in private houses.

The improvements in the ventilation of sleeping-rooms in tenement-houses are rapidly progressing. I find, as a general rule, that the people begin to understand that a better ventilation of their habitations, and particularly of their sleeping-rooms, is essential to health, but I frequently hear the exclamation, "We have air enough—if you cannot do any thing for us to reduce the rent, your labor is superfluous." The ventilation in many, I might say most, of the old tenement-houses I have found improved, but the improvements were, with few exceptions, only partial. The bedrooms are generally provided with a hall window, where practicable, but have no ventilating window communicating with the adjoining rooms. The average class of people does not seem to comprehend yet that both of these windows are necessary to produce a cross-current of air to carry off the foul and supply them with fresh and healthy air. In some cases I found all the ventilating windows that were required, but they were fastened, the occupants entertaining the belief that they had been made there only to introduce light into the room, and being entirely ignorant of their real purpose. I must direct special attention to those inner sleeping-rooms in which it is not practicable to make communication with the hall on account of a room intervening. Where both of these rooms belong to one and the same domicile, I have invariably advised that a communication be established also between the two bedrooms; but, where these rooms belong to two separate families, the law does not authorize, nor does propriety permit, such a communication. Now, these rooms are regular *culs-de-sac*, and the window which should communicate with the adjoining room, and which the law requires, is, of course, insufficient, since no current of air is thereby established to carry off the foul and to supply fresh air.

To improve the ventilation of these rooms, and improvements are here earnestly called for, I would advise that a tube made of tin or zinc, and having a funnel-shaped opening within the bedroom, be made to extend along the ceiling, and its other open extremity be inserted into the nearest heated chimney. This appliance may not, perhaps, be sufficient to establish thorough ventilation, but it would, at least, create a current whereby some of the foul air which always is present in these rooms, and in some cases is almost stifling and unendurable, would be carried off. If the allotment of air-space in the ordinary tenement-houses, in all cases where the family includes more than four people, and where, as is frequently the case, the domicile consists simply of a sitting and a sleeping room, which, together, on an average have a capacity of not more than 1,200 cubic feet, is insufficient, what must be the consequence to a family consisting of six, eight, or ten people, who, from poverty, are compelled to live in so contracted a space with so small a quantity and so bad a quality of air? The results to the observant Inspector and intelligent physician are fully known. We find pallid and ghastly countenances, withered forms, want of energy, indifference to life, not to speak of the predisposition which is here laid to every kind of disease.

A more abundant supply of Croton water to the rear tenement-houses, where the water is only in the yard, is very desirable. The outer man of many a poor individual might profit by an occasional ablution, which he might perhaps resort to were the means ready at hand; but, being obliged to carry the water up four or five flights of stairs, and being too indolent for this exertion, he prefers to wallow in dirt and to suffer himself to be tormented by vermin.

The lighting of tenement-houses is generally defective. In those where the roof over the hall has a bulkhead with sufficient window-space the entries are light enough, but many have what I might call *blind bulkheads*, i. e., simply a wooden box with a door, slatted or not, on top of the roof. This, of course, gives no light at all, and the entries are entirely dark. But few are lighted with gas, and many have only one lamp on the first-floor entry.

In the better-regulated tenement-houses the cleaning of the public stairs and halls is performed by the tenants in turn; and these, and only these, are found in a tolerable and sometimes satisfactory condition. But in those where no such regulations are in vogue it is impossible to give an idea of the quantity of filth, dirt, and garbage, which is sometimes thrown about the premises. I have seen it where the space under the staircase was filled up by at least a cart-load of dirt, ashes, and garbage, emitting a most sickening odor. This cleaning, in turn, of tenement-houses refers, however, only to the public passages, as I have said; the cleaning of the domiciles, where every tenant is his own master and reigns supreme—"too often in dirt"—is performed solely according to the dispositions and habits of the people, and the difference of those habits is often strikingly illustrated in the same house. It is well known, as a general rule, that the lower class of all nations delight to revel in dirt; in my district, the tenement-houses are largely inhabited by this class; they seldom scrub the floors; the bedding is filthy and infested with vermin; the night soil is left standing, emitting a sickening odor, and the vessels are seldom if ever cleaned. If the Inspector happens to inspect their domiciles at dinner hours he finds them full of smoke and offensive steam, which is disgusting to the olfactories and agonizing to the respiratory organs.

The neglect of privies is a nuisance of not uncommon occurrence. If the privy-vault is connected with the sewer of the street, the sewer-pipe is frequently obstructed by reason of the tenants throwing ashes, garbage, and other refuse matters into it; if there is no connection with the street sewer, or in streets where there is as yet no public sewer laid, the vaults are sometimes found filled up even to the seat. The privy-houses, in many cases, are old and dilapidated, and even dangerous to life. The foundation being, perhaps, rotten, and having settled in consequence, there is danger that the structure may be precipitated into the vault beneath; while the seats and floors, being broken, reveal holes through which children may easily fall.

Filthy cellars and court-yards are a common source of nuisance, because they offer the inhabitants most convenient places to deposit ashes, garbage, dirt, and rubbish, emitting, during the hot season, a most sickening odor. All the streets in this district south of Houston Street, and those between Avenues B and C, are extremely filthy; garbage, slops, animal and other refuse matter being thrown in front of the houses. It frequently happens that these streets remain in a filthy condition for weeks, and even for months, until, perhaps to prevent or to check a serious or contagious epidemic, the Board of Health is compelled to have them cleaned. Let us, however, grant that the street contractor performs his duty faithfully, that these streets are cleaned regularly and more frequently, that the cleaning is done thoroughly and well (which is an utter impossibility on account of the defective pavement), what follows? The same kind of refuse which has probably but just been removed is speedily recreated by the people, and the street, which a few hours before was swept, is as filthy as ever. A faulty pavement may well be called a grievous nuisance, and, with the exception of Lewis, Houston, and Second Streets, and Avenue D, all the streets in this district have the old cobble-stone pavement, which, even when new, must have been far from desirable; these are very much out of repair. A new pavement, at least in those streets where the tenement population predominates, is, I may say, an absolute necessity.

The sewerage in this district is very defective, only about two-thirds of the entire length of the streets being sewered, and, on account of the low level of the ground, their outlets are generally below high-water mark.

In conclusion, permit me to say that, for all the various evils in regard to the general mismanagement of tenement-houses, and the numerous nuisances which spring therefrom, there appears to be only one remedy that could be made to work effectually. Let it be made compulsory on every landlord or owner of tenement-houses to employ a person to act as housekeeper or overseer; this person to overlook the tenants or occupants of said houses, and to be held responsible to the Board of Health for the proper execution of such laws as at present exist or that may be enacted hereafter.

Consolidated Statistics of the Survey of the Eighth District:

Total number of tenement-houses		1,066
“ “ private dwellings		754
“ “ unfinished tenement-houses		6
“ “ other kinds of structures		64
“ “ front tenement-houses	819	
“ “ rear “	247	
		1,066
“ “ brick “	1,017	
“ “ frame “	49	
		1,066
“ “ front private dwellings	681	
“ “ rear “	73	
		754
“ “ brick “	681	
“ “ frame “	73	
		754
“ “ families in tenement-houses		7,517
“ “ “ private dwellings		742
“ “ people in tenement-houses		32,473
“ “ “ the district		38,595
“ “ cellars and basements occupied for human habitation		112
“ “ stables		138
“ “ public schools		5
“ “ churches		9
“ “ public markets		1
“ “ police station-houses (Eleventh Precinct)		1

Total number of fire-engine houses	1
" " hospitals (St. Franciscan)	1
" " savings-banks	1
" " manufactories and other shops	84
" " coal-yards	6
" " lumber-yards	4
" " warehouses	1

Total number of tenement-houses deficient in the various sections of the "Tenement-house Act:"

Section 2	621
" 3	114
" 4	146
" 5	65
" 9	656
	1,602

Respectfully submitted:

CHARLES F. W. HAASE,

Assistant-Sanitary Inspector.

DISTRICT No. 9.

E. HARRIS, M. D., *Sanitary Superintendent.*

SIR: I have the honor to submit the following report on the general condition of the Ninth Sanitary District, and of my labors in the same as Assistant Inspector, during the last nine months.

This district is bounded, on the north, by West Fourteenth Street; east, by University Place and Wooster Street; south, by West Houston Street, and west, by North River.

In respect to geological formation, it may be divided into three portions, whose longitudinal boundaries are all parallel to each other and to the North River. The portion on the west side is about two blocks in width, and has been reclaimed from the river, the soil being a compound of earth and refuse constituting what is called "made land." The soil in the middle portion, which comprises the greater part of the district, is dry sand, and that of the eastern portion drained marsh and meadow lands. The surface of every portion of the district, except the extreme river-front, lies sufficiently high to make thorough drainage practicable.

The buildings consist of private houses interspersed with tenement-houses, stores, manufactories, and other structures. The least number of tenement-houses and manufactories is to be found north and east of West Fourth Street, while the greatest number is situated west of Hudson Street and Eighth Avenue. There are no complete squares of tenement-houses, but there are many cases of solid packing of front and rear tenement-houses on the same lot.

Many of the streets are important thoroughfares, as all the west side avenues have their outlets through this district.

The labors of the Assistant Inspector have been, inspecting premises complained of by citizens and policemen; inspecting premises where contagious diseases were reported to be; vaccinating and surveying tenement-houses. The kind and number of inspections which were made for the purpose of making reports of premises or nuisances are shown in the following table:

Kind of Nuisance or Premises inspected.

	Number of Inspections.		*Number of Inspections.*
Tenement-houses	1,042	Schools and asylums	13
Private "	86	Breweries and factories	22
Cellars	41	Manure and dumping grounds	4
Stables	180	Piers and bulkheads	17
Privies and water-closets	82	Small-pox (cases)	28
Alley-ways, sewers, gutters, and pavements	56	Fever (typhus) "	7
Yards and chimneys	6	Other diseases	3
Lard-rendering establishments	18	Total	1,605

So far as I have been able to judge, the owners, agents, or executors, of premises, against which I have made either tenement-house or special complaints, have, with very few exceptions, speedily complied with the requirements of the law, or the orders of the Board of Health, after notice has been sent them; and in no instance has the Board been obliged to execute its own orders.

The whole of Little Twelfth and Weehawken Streets, Thirteenth Avenue, Greenwich Avenue, from Horatio Street to Eighth Avenue, and small portions of Greenwich and Washington Streets, are not sewered. All the other streets have sewers, and, during the past summer, have been kept in fair sanitary condition; although it has been necessary to make complaints sometimes against filthy streets and gutters.

No cause for complaint has been found in the condition of the piers and bulkheads.

Jefferson Market, the only large market in the district, has been kept in a cleanly and wholesome condition.

What was known as the "Gansevoort Street Dumping-ground," situated on the North River at the foot of Gansevoort Street, was used until last March as a place for dumping stable-manure and street-dirt; but, since that time, none of the former, and only the latter, has been dumped or kept there. Boats at that place are now loaded with stable-manure directly from the carts.

All the livery-stables, and nearly all the other large stables, have proper sewer connections. About one-half of the whole number of stables in the district have tight manure-vaults in which the manure is kept until they are filled, or until it is convenient for the cartmen to empty them; and in the other half the manure is kept until removed in open bins or piles. The construction and use of tight manure-vaults, as prescribed by Section 99 of the Code, should not, in my opinion, be generally recommended, on account of the more rapid decomposition of the manure, and consequently greater evolution of noxious and offensive gases when kept in such vaults than when kept in open bins or piles.

Improvements are much needed in the drainage of most of the smaller stables, such as contain less than ten horses each. These, for the most part, are not properly connected with the street-sewer, and the liquid manure from the stalls and yards is either allowed to saturate the soil around and beneath the stables, or is conducted in open drains from the premises to the street-gutters, along which it may stagnate or slowly find its way into the street-sewer. The drainage of stables and their yards, so left or disposed of, must, by its evaporation or exhalations, to a certain degree contaminate the air of the neighborhood, and so contribute a share to the causes of disease and death. There are, perhaps, more of this class of stables in this district than in any other in the city.

The principal complaints against private houses have been concerning leaky roofs and eaves, gutters, and offensive privies and water-closets..

There are three establishments in the district where lard is rendered in tight steam tanks. These are all grievous and continual nuisances, except in the coldest weather, two of them being situated in very populous neighborhoods. Various inventions and improvements have been applied to steaming apparatus used in these rendering-houses. These improvements had in view the preventing of foul and sickening odors that arise, especially in warm weather, from the tanks and scrap or refuse. But, so far as I have been able to ascertain, they have all substantially failed to accomplish the object sought. From these experiments it appears that the steaming of animal substances in air-tight tanks produces changes in the chemical constitution of the muscular and connective tissues, which are followed by rapid decomposition. This theory is proved, partly by the offensive odors that arise from the tanks during the steaming process, and mostly by the fact that the scrap, especially in warm weather, is found to be in a putrid condition nearly as soon as it leaves the press. There are many smaller establishments in the district, in which lard is rendered in open kettles. I have inspected all of these, and in none of them have I found the process offensive or detrimental to health; and the scrap is so far from being offensive, that it is somtimes used by the workmen as an article of food. By comparing the facts relative to these two methods of rendering lard, we are forced to the conclusion that, so far as sanitary results are concerned, the process by steam is a failure, and therefore ought not to be permitted in the built-up portions of the city.

There are no fat-rendering or bone or offal boiling establishments in the district.

In a limekiln in West Twelfth Street five pits of oyster-shells are kept burning night and day. The gases from these pits, in my opinion, injuriously affect the sanitary condition of premises situated in the vicinity of the kiln, but to what degree has already been discussed before the Board of Health.

There are several mills, founderies, and factories in that part of the district bounded by Horatio, Washington, and West Eleventh Streets and Thirteenth Avenue. Many complaints are made against these premises by citizens living in their neighborhood. The complaints state that smoke from the chimneys of these mills and factories is at times very offensive, by reason of its entering complainants' apartments, or making it necessary to keep their doors and windows carefully closed to exclude it. The tops of these chimneys are all from ten to thirty feet higher than the tops of the highest inhabited houses in their vicinity. There is a law applied to many of the manufacturing towns in Scotland and England which compels the owners of mills, factories, etc., to build their chimneys a certain height, which in some places is two hundred and fifty feet or more above the ground. Although its necessity in this city is at present doubtful, nothing but the passage and enforcement of such a law or ordinance, or the stopping of the business of mills and manufactories in or near thickly-populated portions of the city, would prevent the nuisances above mentioned.

During the last epidemic of small-pox in this city the first case that occurred in this district was on the 19th of April; and during the three succeeding months twenty-eight cases of this disease were referred to me, from the Central Office, for examination and report. The premises on which these cases were reported to be, after conferring with the physician in attendance, when he could be found, were immediately inspected, and such advice, in reference to isolating and disinfecting, as the exigencies of the case seemed to demand, was given by the Inspector to the tenants. In some cases the visits of the Inspector were only formal, all necessary advice concerning the sanitary condition of the premises having already been given by the attending physician. Vaccination was also immediately offered, free of charge, to every family living on the block on which a case of small-pox was found. The result of these efforts to prevent the spread of the disease was very satisfactory to all; for the records show that there were only two houses in the whole district in which more than one case occurred during the epidemic.

The month of June was spent by three assistants and myself, under direction of the Board, in offering vaccination to every family in the district, who would, if it were needed, be likely to accept it gratuitously. Vaccination was also offered in the same way and accepted in all the asylums and in all the schools, except the ward schools in the Ninth Ward. By a careful examination of the registries of vaccination which were accurately kept by the teachers in the last-named schools, it was ascertained that all the scholars in attendance had been vaccinated or revaccinated during the last nine years. The following is a tabulated statement of the work of vaccination:

Total No. of houses visited..........	2,734	Total No. of vaccinations in schools..	185
Total No. of schools and asylums visited........................	13	Total No. of primary vaccinations....	460
Total No. of families visited.........	6,081	Total No. of revaccinations..........	475
		Total No. of vaccinations...........	935

The offer of vaccination by the officers of the Board was kindly received by all to whom it was made, and among the poorer classes was accepted by all who needed it. No unpleasant accident, such as erysipelas or serious inflammation, occurred among any of the cases so vaccinated. Owing to the interest that was awakened in the public mind to the importance of vaccination by a knowledge of the means which were being used by the Board of Health to prevent the spread of small-pox, it is probable that, during the epidemic, many more people in the Ninth District were vaccinated by private physicians than by those employed by the Board of Health. But one case of small-pox occurred in the district after the work of vaccination was completed.

Of the tenement-house survey, that portion of the district bounded on the north by Jane Street, Greenwich Avenue, West Eleventh Street from Greenwich Avenue to Sixth Avenue, Clinton Place from Sixth Avenue to University Place, east by University Place and Wooster Street, south by West Houston Street, and west by North River, has been completed. This portion contains as follows:

Number of blocks or squares........	118	Number of stables..................	132
Number of tenement-houses..........	557	Number of other structures.........	289
Number of private houses...........	2,601		

Statistics relating to Tenement-houses.

Total number of tenement-houses surveyed....................................	557
" " " families residing in same.....................................	3,578
" " " persons " " "	14,535
Average number of families in a house......................................	$6\frac{45}{100}$
" " " persons " " "	$26\frac{1}{100}$
Largest " " families " " "	32
" " " persons " " "	127
Total number of tenement-houses with water-closets..........................	104
" " " " " " privies......................................	453
" " " " " " " not sewer-connected.................	37

The number of violations of each section of the "Tenement-house Law," which have been found in tenement-houses during the survey, are shown as follows:

Section 1, none; section 2, 179; section 3, *; section 4, 26; section 5, 68; section 6, 90; section 7, none; section 8, 390; section 9, 360.

Concerning ventilation, in all of the tenement-houses that I have examined which have been erected or converted since the passage of the present "Tenement-house Law," I have found but little to complain of; but for the most part the tenement-houses in this district were erected or converted many years ago, and in the great majority of these, except where complaints had been made by my predecessor, I have found apartments and halls without adequate means of ventilation. For the dark bedrooms adjoining halls in all houses where such an arrangement exists, through-ventilation has been and is being secured by means of transom windows communicating with halls and ventilators in the roofs at the tops of the halls, as the law directs. But great difficulty is often found in securing means for proper ventilation in cases where an inner bedroom, which is situated on a floor that is occupied by two or more families, is separated from the hall by another bedroom. Now, when the bedroom adjoining the hall is occupied by one family, while the one remote from the hall is occupied by another family, we find that the last-mentioned room cannot be ventilated by means of transom windows without causing the sleeping-room of one family to communicate directly with the sleeping-room or sitting-room of another. This, for obvious reasons, is not practicable. In such a case nothing but an air shaft or flue, leading through the roof from the room that we wish to ventilate, will fully answer the purpose. A doubt seems to exist in the minds of some of the officers of the Board of Health either as regards the expediency of

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* Inspectors were instructed to make no complaints against violations of this section, but to leave them for the Inspector of Buildings.

the last-mentioned plan of ventilation, or, as to whether such an improvement could be legally demanded of the owner by the Board, under the provisions of Section 18 of the Tenement-house Law; and, hence, most of these inner rooms that are remote from halls, and situated as above described, remain imperfectly ventilated.

Comparatively few stairs and banisters have been found in a condition dangerous to life, and but few complaints have been made against leaky roofs.

The condition of tenement-houses, as regards sewerage and the sanitary arrangement of privies and water-closets, has, during the last few months, been very much improved. In nearly every tenement-house and yard, situated in a street that is sewered, proper sewer connections have been and are being provided.

The number of inhabited cellars requiring permits, which have been found in the district since the survey began, is ninety. *Twenty-five* of these have been reported against as being too dark and damp to be fit for human habitation, and, except one or two, have all been vacated by order of the Board. In the remainder of the ninety, a fair sanitary condition has been obtained by means of improvements in drainage and ventilation, and permits for their occupation have been granted by the Board. None of these cellars were used exclusively for lodging-rooms.

About one-third of all the tenement-houses in the Ninth District are provided with garbage-vessels, the one belonging to each house being used in common by all the families in the house for the reception of ashes and other refuse matters. These vessels generally consist of wooden boxes or barrels which are kept on the sidewalk in front of the houses, or in the yards or cellars belonging to the same. Of the other two-thirds most of them are small houses occupied by a class of intelligent people who deliver their ashes and garbage every morning in pails and other small vessels directly to the cartmen; and in front of the remaining number, which are larger houses, and are occupied by more careless tenants, garbage and ashes are frequently seen lying in the street and gutter. In these cases complaints have often been made against the premises under Section 8 of the Tenement-house Law, which requires for every tenement or lodging-house "proper and suitable conveniences or receptacles for receiving garbage and other refuse matters." In houses where this section of the law is not complied with, and which contain a large number of families, the habit of throwing garbage in the street by the tenants is owing either to their carelessness in not bringing it to the sidewalk in time to have it taken up by the cartmen, or to the fact that the cartmen sometimes omit one or more of their daily rounds, or perhaps make them at irregular hours, so that, in either case, if the tenants have nowhere to store their garbage and ashes on the premises, rather than run the risk of losing a pan or pail by allowing it to remain all night on the walk, it is emptied in the street.

There is generally a willingness on the part of owners to provide for tenement-houses suitable vessels for the reception of refuse, but most of them are ignorant of the best form and material to be used in their construction. In my opinion the owners should be instructed on these points by an ordinance of the Board of Health; and this, in connection with the enforcement of Section 8 of the Tenement-house Law, wherever a house contains more than six families, would abate the nuisances of garbage in streets, yards, or cellars, except in very rare cases where their causes would be chargeable to the neglect of the employés of the Street-cleaning Commission. In my opinion the best garbage-vessels are made of strong sheet-iron plated with tin, are cylindrical in form, open at the top, with no covers, each having a capacity a little greater than that of an ordinary flour-barrel, and being provided with two handles by which it can be carried or lifted by cartmen. These vessels are very much superior to wooden boxes or barrels, for the first cannot absorb and retain in their substance offensive liquids; they are not liable to get out of repair, nor can they be used by mischievous boys in lighting bonfires, while in every particular the exact reverse of this is true of the last two.

The sanitary condition of tenement-houses has been greatly improved during the past summer by the enforcement of the law in respect to the cleaning and whitewashing of blackened and filthy walls and ceilings of halls and apartments; the emptying and disinfecting of full and offensive privy-vaults, and removal of sewer obstructions belonging to the same; the removal of filth and garbage from yards, cellars, and alley-ways; and the constructing of traps on waste and sewer-pipes to prevent the rising and spreading of offensive exhalations from sinks in houses and yards.

In the majority of tenement-houses in this district the occupants are the families of clerks, cartmen, and mechanics. These classes generally appreciate the spirit and wisdom of the Tenement-house Law, and, so far as they are concerned, obey its requirements. The remaining portion of the tenement-houses, however, is filled with the poor and uneducated families of laborers, junkmen, and unfortunates, who interest themselves but little in matters of reform, except the lowering of rents, and who are totally ignorant of the rudiments of physiology and hygiene. On the last two subjects these people, in my opinion, might be instructed by some plan of popular teaching. Whatever the parts and details of such a plan might be, if successful, the benefits resulting therefrom would be felt by all classes of citizens. For many of the common and contagious diseases originate in and are fostered by the careless and filthy habits of these poor people, and through their ignorance are often scattered through a community. Therefore, if some of the causes and sources of these diseases could be removed, a proportionate security would be gained for the health of the public. Again, it is from this same class of people that our public hospitals and almshouses are mostly filled; and by preventing disease among them in any given number of cases, and thus keeping them out of the public institutions, the public would be saved the expense of their care and treatment, and at the same time would be enriched by the results of their productive labors.

Appendix.

Since making the above report, the tenement-house survey in my district has been completed. The complete statistics of the survey are as follows:

Total number of blocks or squares	149
" " tenement-houses	689
" " private "	3,842
" " stables	202
" " other structures	393

STATISTICS RELATING TO TENEMENT-HOUSES.

Total number of tenement-houses surveyed	689
" " families in same	4,464
" " persons " "	18,131
Average number of families in a house	$6\frac{45}{100}$
" " persons " "	$26\frac{1}{100}$
Largest " families " "	32
" " persons " "	127
Total " tenement-houses with water-closets	114
" " " " " privies	575
" " " not sewer-connected	41

Respectfully submitted:

N. S. WESTCOTT,
Assistant-Sanitary Inspector.

December 15, 1869.

DISTRICT No. 10.

E. HARRIS, M. D., *Sanitary Superintendent.*

SIR: According to order, I have the honor to submit the following annual report for a period of labor extending from January 20, 1869, to October 31, 1869, in the Tenth Sanitary District:

This district comprises the 16th Ward, and is that portion of the city which is bounded north by Twenty-sixth Street; south, by Fourteenth Street; east, by Sixth Avenue; and west, by the North River.

The Tenth Inspection District is mostly composed of tenement-houses and private dwellings, the number of other buildings, such as factories, warehouses, etc., being rather small in proportion to that of the tenement and private houses.

The private dwellings are generally found in the cross-town streets, between Sixth and Eighth Avenues; while the tenement-houses are seen occupying the avenues themselves, and the cross-town streets, west of Eighth Avenue.

There are, of course, many exceptions to this.

The elevation of the highest portion of this district above tide is thirty-nine feet.

The following list shows the amount of labor during a period of time commencing January 20, 1869, and ending October 31, 1869:

Inspections and Reinspections.

Number of tenement-houses	1,052
" private dwellings	15
" cellars and basements	379
" yards, courts, and areas	505
" privies and water-closets	287
" sewers, drains, etc.	29
" stables	21
" schools	5
" stores, factories, and warehouses	3

Statistics relating to Tenement-houses.

Number of tenement-houses surveyed	653
" families residing in them	4,201
" persons " "	18,550
Average number of families in a house	6.5
" " persons "	28.5
Largest " families in a house	25
" " persons "	108
Total number of tenement-houses with water-closets	13
" " " " privies	640

The beneficial results derived from the application of the improvements in regard to bedroom and hall ventilation are quite striking, and the value of the work, under the direction of the Board, speaks for itself. If a tenement-house, for instance, be inspected after its owner has complied with the 2d section of the Tenement-house Act, each bedroom that has no direct communication with the external air will then be found provided with two ventilating windows, one of them communicating with the hall, and the other communicating with the adjoining sitting-room, which itself communicates with the external air. These improvements are especially appreciated by the Sanitary Inspector, who can draw a comparison between the condition of a house at the time of a first inspection, when, perhaps, the bedrooms had no ventilation of any kind, and its condition at the time of a reinspection, after this second section of the law has been complied with. The importance of this section of the law increases in proportion to the crowding of the inhabitants. If, for example, the average cubic space of air in a well-ventilated bedroom is only 129 cubic feet per occupant (as is the case in a tenement-house in my district), what would be the condition of the air in such a room with no ventilating windows whatever?

The 9th Section of the Tenement-house Law, which requires that the premises shall be kept clean and in good repair, is also very wisely enforced. The whitewashing of the walls and ceilings twice a year is of paramount importance, and the improved appearance which results from it, and which is of itself gratifying, is only secondary to the more important fact that the whitewashing of these walls acts, in a certain degree, as a disinfectant, especially when any contagious disease has existed in the house.

Privies.—Privies are, in my opinion, more suitable for tenement-houses than water-closets, provided the vaults be well built and sewer-connected, there being at the same time a sufficient amount of water for flushing purposes.

But, unfortunately, all privy-vaults are not properly built, some of them having no sewer connection, and some of them having the drain-pipe within a few feet of the surface, so that the vault has to be nearly full before its contents can run into the sewer. Such privies are exceedingly foul and offensive, and especially so after a hard rain, for the water rushing into the vault agitates its contents and these give rise to offensive gases. A privy of this description is worse than one which has no sewer connection, and for the following reason:

Generally, where it is not sewer-connected, it is not flushed by any water, the contents are more solid, are not disturbed, and, as a consequence, they are less offensive—when it gets entirely full it is disinfected, emptied, and cleaned. But a privy, sewer-connected in the manner above described, never gets full enough to require being emptied, is generally flushed by a sufficient amount of water to disturb its contents, and, never being entirely full or empty, gives rise at all times to more or less offensive exhalations. But where the vault is built water-tight, where the drain-pipe is low down, and where it is thoroughly flushed, being at the same time covered with a good privy-building, very little odor arises therefrom.

The condition of these privies in my district shows a vast improvement.

Water-closets.—Water-closets in tenement-houses are objectionable for the following reasons:

1. Difficulty, if not impossibility, at all times, of having a sufficient supply of water for flushing purposes.
2. The difficulty of keeping the soil-pipe free from foreign substances.

Excepting in first-class tenement-houses, which are sometimes occupied by intelligent people, the tenants of ordinary houses are generally careless and ignorant, and they do not pay attention to what may be said to them concerning their own good and comfort. With such a class of people, water-closets are, in my opinion, very bad. For sooner or later the soil-pipes will become obstructed by foreign substances being thrown into them, and, when once obstructed, it is a serious matter to repair them. Moreover, when once obstructed, they are more offensive and filthy than privies. This has been my experience in three houses furnished with water-closets, and hence my preference for privies in tenement-houses.

Even with the greatest care on the part of owners, agents, or house-keepers, some tenants will throw substances into privies and water-closets, which obstruct the drain completely.

Stables.—There is a marked improvement in the condition of the stables in my district. Stables which formerly had no receptacles for manure, are now provided with manure-vaults, some of these being sewer-connected, so that the liquid contents may be disposed of at once. The chief nuisance arising from some stables is due to the fact that, during the day, the litter of the horses (which is composed of straw impregnated with urine) is exposed to the external air for the purpose of drying. In some instances this straw and manure extend for some distance on the sidewalk, and give rise to odors which are very offensive, and can be perceived at a great distance.

Cellars, Courts, and Areas.—One of the most important and useful measures taken by the Board, for promoting health and diminishing disease, is the enforcing of certain alterations and improvements in the condition of cellars used as human habitations, and their evacuation where these improvements are not practicable.

There are very few of these low cellars used as dwellings in my district. A few of them have been evacuated, and the cellars and basements now used for human habitation will generally be found to comply, if not with the letter, at least with the spirit of the law. The areas are generally found excavated to the proper depth, flagged, and drained.

The excavating of an area to a point six inches below the level of the floor (as the law prescribes) is not always enforced, for several reasons, such, for instance, as rendering the foundation of the house insecure, etc., but, in all cases, it must be properly graded, flagged, or bricked, and drained. In fact, all the *necessary* improvements will be found to have been made where the premises have been submitted to an inspection, and a report has been made upon their condition. The improvement in the condition of these cellars and basements is easily perceived.

Garbage.—The exposure of garbage, in the streets and street-gutters, is one of the crying nuisances in my district, and, although the measures taken by the Board in this respect have diminished the evil to some extent, a great deal remains yet to be done for the radical abatement of the nuisance.

Several plans have been discussed from time to time regarding the shape, size, and material of garbage-vessels, and the manner of disposing of their contents; but the subject presents so many difficulties that the success resulting from these attempts has been very imperfect.

In most tenement-houses, a vessel of some kind is placed on the side-walk, in the hall, or in the yard, for receiving the garbage and refuse matters which are to be collected by the ash-cart. These vessels vary in their kind from a small tin pan to a barrel. In many cases, the vessel being too small for the quantity of garbage to be deposited in it, the surplus is thrown into the street-gutter. Where there are no garbage-vessels at all, the same thing naturally occurs, although it is rare to find a house which is not furnished with garbage-vessels of some kind.

The greatest cause of exposure of slops and garbage in the streets, is the carelessness or ignorance on the part of the lower classes of tenants, who seem to throw their garbage and refuse matters into the street by preference. This is especially the case on 26th Street, between Seventh and Eighth Avenues, on Tenth Avenue, between 24th and 26th Streets, and in some other localities where the street-gutter will be found actually filled with garbage, although a barrel may be seen standing on the sidewalk in front of the house.

It is my impression that the throwing of slops and garbage into the street can only be prevented completely by the arrest of any person detected in the act of so doing, and his being punished accordingly. Until this can be done, it seems to me that the nuisance will continue to exist more or less, and I derive this opinion from the fact that in some tenement-houses, even with a large number of families, no garbage is ever seen exposed in the street or street-gutter, even where the ash-cart does not come every day, while, in the case of other tenement-houses, this nuisance always exists, notwithstanding the sufficiency of the garbage-vessels, and the daily visits of the ash-man.

Faulty Pavements and Gutters.—The inequality of pavements, and the want of proper grading of the street-gutters, are, in portions of my district, the causes of their filthy condition, part of the liquids remaining stagnant in the depressions, and causing, at times, offensive and deleterious exhalations. These gutters should be kept in good repair, and should be flushed from time to time by a sufficient amount of water. Street-gutter nuisances would then diminish greatly in number.

Some of the streets in the Tenth District are badly paved, and favor by their imperfect condition the accumulation of dirt and filth. Moreover, they are not cleaned and swept as often as they should be. I must say, however, that within a few months the condition of streets has been very much improved.

There are no sunken lots in my district.

The lower classes of people, as a general thing, are very ignorant as to matters regarding hygiene, and, although they have of late improved a little in this respect, yet they do not seem to understand the necessity of what is being done by the Board in their behalf. For example, it is often the case that tenants object strongly to having their bedrooms properly ventilated, notwithstanding the explanations given to them by the owner or the sanitary officer. Occasionally they have positively refused to have any windows made.

While this is the case with the more ignorant, an entirely different feeling exists among the better classes, who always seem glad to see a sanitary officer visit their domiciles, showing the greatest willingness to give him all possible information, and to show him all the defects which are susceptible of correction. This clearly shows the increasing knowledge of the people in regard to hygiene.

I will add that owners and agents, as a rule, recognize the necessity and usefulness of the Board's work, and they always pay prompt and cheerful attention to any orders or suggestions given them. My intercourse with them, without a single exception, has been of the most pleasant and agreeable kind, and any advice that I have ever given has always been received by them with the greatest courtesy and appreciation of its spirit.

Summary of Sanitary Survey, etc.

Number of tenement-houses	653
" private houses	2,680
" stables	104
" other structures	62
" tenement-house families	4,201
" tenement-house population	18,550
Average number of families to a tenement-house	6.50
" " persons "	28.50
Largest number of families to a tenement-house	25
" " of persons "	108
Total number of tenement-houses with water-closets	13
" " " with privies	640
" " " having privies without sewer connection.	
Number of market-stands	23
" manufactories	53
" fat-rendering establishments	none.
" stores	823

Respectfully submitted:

LUCIEN DAMAINVILLE, M. D., *Sanitary Inspector.*

NEW YORK, *January* 1, 1869.

DISTRICT No. 11.

ELISHA HARRIS, M. D., *Sanitary Superintendent.*

SIR: I have the honor to submit the following Report, embodying the results of my labors during the past nine months in the Eleventh Inspection District. This district includes the 18th Ward, extending from Fourteenth Street to Twenty-sixth Street, and from Sixth Avenue to the East River. It contains 110 squares—large and small—and four parks, viz.: Union, Madison, Gramercy, and Stuyvesant—the last being intersected by Second Avenue. Of the 110 squares mentioned, 102 are wholly or partially inhabited, their estimated population being 70,000. Broadway, between Seventeenth and Twenty-first Streets, occupies the highest elevation in this district, having an altitude of 41 feet above high-water level, and from this street, easterly, is the principal sewer-outfall of the district.

The streets in this district devoted principally to trade are, Broadway and Sixth Avenue on the west side, and Third and First Avenues on the east side; while Fourth and Second Avenues and Avenues A and B are also occupied by numerous shops. The vicinity of Union Square and thence along Broadway to Madison Square has lately been undergoing a complete transformation, colossal emporiums of merchandise having replaced the stately dwelling-houses or insignificant shops which, until lately, occupied the site. In that location, without doubt, is now being established definitely the grand commercial centre of our metropolis.

The 18th Ward comprises two great social divisions separated by the Second or Third Avenues, east of which dwell about nine-tenths of its whole tenement-house population, and west of which are found almost exclusively the abodes of the better classes. As my duties have been essentially restricted, as a rule, to the former of these two regions, I shall confine the remainder of this report to the enumeration of my observations therein.

Since the 1st of March, 1869, about which period was inaugurated the official inspection of each district ordered by the Board and known as the "Sanitary Survey," my labors have embraced the examination of 39 squares, all occupied to a greater or less extent by tenement-houses, and situated east of Third Avenue. Of this number 35 squares lie east of Second Avenue and include all the tenement-houses in that division of the district. Considering this large aggregation of tenements individually inspected in the searching and critical manner demanded by the Board, it is safe to assume that the facts and figures resulting from such examinations are perfectly reliable as statistics, except in the single item of population. It is impossible, without practical experience, to estimate the difficulty of obtaining a reliable census in these crowded districts, even when visiting every family and cross-questioning the inhabitants in every conceivable manner. Evasion, falsehood, and stupidity, combine to thwart one's most determined efforts. I have found an old woman sitting alone in her apartment of three little rooms, who informed me positively that her family consisted of only five persons, viz.: herself, daughter, son-in-law, one child, and one boarder; when, after a diligent inquiry among her neighbours, I discovered that she accommodated no less than six boarders—how, or where, it is difficult to conceive. It is quite common, especially among the Irish, to find an apartment of two or three rooms in which, besides the regular family, some half-dozen of these "boarders," consisting mostly of unmarried laboring-men or mechanics, are furnished in some mysterious manner with food and lodging. I cannot, therefore, vouch for the accuracy of my census, but think it probable that at least one-fourth more should be added to the population of even those houses in which I have merely made an estimate.

The following are the statistics of the Sanitary Inspection:

Total number of tenement-houses surveyed	874
" " " inhabited	860
" " " being built	14
" rear " "	82
" frame " "	14
" stone " "	4
Number of two-story inhabited tenement-houses	6
" three " " "	93
" four " " "	480
" five " " "	243
" six " " "	38
" families residing in the above	8,849
" persons " " "	38,253
Average number of families in a house	10
" " persons " "	44
Largest " families " "	22
" " persons " "	126
Number of tenement-houses with water-closets	38
" " which have been required to comply with 2d Sec. "Ten.-house Act" (bedroom and hall ventilation)	603
4th " " " (leaky roofs, dangerous stairways, etc.)	243
5th " " " (privy and closet nuisances, defective drainage, etc.)	239
6th and 7th " " (cellars inhabited without permit)	85
8th " " " (dangerous storage — keeping animals, etc.)	20
9th " " " (dirty walls—filth—no notice of owner or agent)	442
Tenement-houses in which the law has not been found violated	71
" designated as "new," i. e., built within the last four years	116
" " " "dirty"	103
" " " "model houses"	26

The above houses are inhabited as follows:

Tenement-houses inhabited by Irish	423
" " Germans	88
" " Americans	16
" " Negroes	1
" " A mixture of nations	332

The above houses are owned as follows:

By Germans	371
" " who are also residents in said houses	130
" Irish	263
" " who are also residents in said houses	64
" Americans	179
" " who are also residents in said houses	7
" other nations or unknown	47

Average rent for an apartment consisting of one living-room and one bedroom	per month	$8 50
For apartments of three or four rooms	"	12 00
" a whole floor	"	20 00

In the above tenement-houses are to be found 700 shops, of which there are:

Groceries	156
Liquor-stores	92
Lager-bier saloons	59
Cigar-shops	34
Butcher-shops	49
Bakeries	37

The rest being of various character.

In the squares surveyed were found in addition—

Private houses (as well as could be ascertained)	402
Houses inhabited by two families living separately	53
" " " three " " "	80
Stables (accommodating 1,934 horses)	204

The beneficial results of the Tenement-house Law to this community have now become so universally apparent that it appears superfluous to discuss the subject, except with reference to a few additional improvements suggested by the experience of the inspectors and occasionally illustrated by benevolent landlords.

Ventilation.—I am able to designate but few tenement-houses now unsupplied with a proper ventilator in the roof over the hall, and whose bedrooms, as far as practicable, are not adequately ventilated. Considering that I have entered complaints against over six hundred houses as deficient in such respects, the disposition generally of owners to obey the requirements of the law in this particular is a notable fact. But, as has been frequently pointed out in previous reports of inspectors, the peculiar construction of many houses modifies or renders nugatory the salutary purpose of Section 2, unless considerations of health be regarded as paramount to those of morality. Under circumstances, therefore, where it is manifestly impossible to construct the necessary transom windows between adjacent bedrooms without encroaching upon the privacy of strangers, a contingency not anticipated in the law, and where the Board properly does not insist upon the literal execution of Section 2, it seems essential that some other contrivance should be devised, such as a ventiduct or shaft of liberal calibre communicating constantly with the open air, or a ventilating flue within the wall of the building. I cannot, however, speak favorably of the latter method. It does not determine a proper circulation of air; and what air may have remained within the flue for any length of time appears damp and deteriorated, which fact the tenants themselves instinctively recognize, and when not disturbed they are in the habit of sealing up the apertures.

The necessity for ventilating the apartments of the poor to as bountiful an extent as practicable becomes more apparent when we reflect how slender a quantity of even this vitiated air is allotted them. My observations give an average to each individual of only 340 cubic feet in bedrooms, and 650 cubic feet in living-rooms.

Lighting of Halls.—The lighting of tenement-house halls is another improvement essential to health and cleanliness. Of the 116 houses designated in my Sanitary Survey as "new" (i. e., constructed within the last four years), the majority have their halls comparatively well lighted by means of windows over the doors on each landing, and a skylight at the top. Most of the older tenements, however, were constructed without any reference to such want, and their halls are pervaded by a "dim obscurity," or by utter darkness. These should be lighted in the manner of those more recently built, above described; and under no circumstances should any such dwellings hereafter be erected without attention to this important requirement.

Rear Tenement-Houses.—Eighty-two tenement-houses, or about 10 per cent. of those thus far surveyed by me, are marked "rear," each one being usually situated on the same lot with another "front" dwelling. As a general rule, in my district this rear class of houses is superior to the other in three essential points—ventilation, light, and number of inmates. These buildings average about twenty-five feet in depth, and there is almost invariably an open space behind them, allowing their apartments a through-and-through current of air, while their halls are light and well ventilated. I would take occasion, in this connection, to mention that owners are in the habit, when erecting such houses, of infringing upon the minimum space established by law as necessary between front and rear tenements—a practice which should be discountenanced.

Water-Closets and Privies.—Thirty-eight houses are noted in my survey as being furnished with water-closets. I have found these almost constantly in good condition, a fact which bears with some force upon the question of the adaptability of such arrangements to tenement-houses. I believe that, with a proper supervision over tenants by some authorized resident of each house, there would be very little difficulty experienced in keeping in order properly-constructed water-closets; and that in the end they would prove more economical than the privies now so generally in vogue. These privies are, in my opinion, the most prolific and dangerous source of atmospheric contamination existing among us. Their effluvium permeates the whole tenement-house district during the warm season, being perceptible even in the streets. They are almost all sewer-connected, so to speak, but usually in so imperfect a manner as to entirely defeat the intention of the law. These facts have been too frequently dilated upon in previous reports to need any further elaboration.

Drainage of Areas, Cellars, and Yards.—Upon assuming my functions of Inspector, I perceived that very little attention had been given to the drainage of areas. I have never neglected directing the attention of the Board to this point, and have generally seen the desired object accomplished. This should certainly be regarded as one of the most important means for insuring the salubrity of a dwelling. With regard to yards, the fact that many are unpaved renders the subject of their proper drainage a difficult one. The surface of such yards is always irregular, and stagnant water accumulates in the depressions. No yard can be adequately drained unless it be well paved. The cellars in my district are generally kept clean, and are mostly dry. A few, however, in the vicinity of the East River, are subject to occasional inundation, being situated on ground originally marshy, and traversed by streams. In most of these instances a drain connecting with the sewer, or a thorough cementing, has been effectual in remedying the evil.

Basement Dwellings.—There has been very little cause for complaints on this score against the houses of my district. It has been found practicable to improve many basements, so as to render them habitable; and in but few cases have I deemed it necessary to recommend the actual vacation of any such dwelling.

Garbage.—The question of how to dispose of the garbage daily accumulating in tenement-houses is one which has been so frequently and fully discussed, that it would appear to have been exhausted without the discovery of any adequate solution. Certainly no regulation of the Board of Health can be efficient in suppressing the obnoxious practice of casting this refuse into the streets unless seconded by the earnest and determined efforts of the police; and that such efforts can be employed effectually is shown in all the large European cities.

Filthy Streets.—The streets of the 18th Ward east of Third Avenue have been, during my term of service, dirty as a rule, and some of them horribly filthy. The contractors have not performed their duties with the regularity demanded by their engagements. West of Third Avenue—the streets being mostly taken care of by private subscription—have generally been clean.

Pavements and Gutters.—These are in excellent condition west of Second Avenue. In a few places the Nicolson pavement, or some modification of it, has been constructed; and it seems to be well adapted for quiet neighborhoods. The concrete which has been laid over other pavements has proved a complete failure, and an intolerable nuisance. East of Second Avenue the streets are not well paved, and the gutters are generally in faulty condition, not corresponding to the established grade, and having stagnant pools at frequent intervals. If the attention of the sanitary police were exclusively directed to the regulation of gutters in tenement-house districts for a period of six months, I believe that the health of the city would be benefited materially.

Stables.—I have inspected about 200 stables, accommodating some 2,000 horses. Many of these structures are in excellent sanitary condition; but in advancing toward the East River one discovers numerous rows of dilapidated shanties devoted to this purpose, which I have usually found filthy, and with no receptacle for the deposit of manure prior to its removal. It appears harsh and unnecessary in such cases to insist upon the construction of a manure-vault such as the law specifies; but an adequate tight box is—very wisely—regarded by the Board as fulfilling all indications. This plan has usually been cheerfully carried out by the proprietors of such establishments, the majority of which are now very much improved.

House-keepers.—The plan, proposed by the Sanitary Superintendent, of endeavoring to secure an authorized house-keeper in every tenement-house is supported by such palpable arguments that there can be no question of its utility. That it is practicable is now well illustrated by many examples of superior tenement-houses thus superintended.

Factories.—In the eastern section of this district there are numerous and extensive factories and founderies, the sanitary state of which is quite generally fair. Many of these I have found deficient in suitable privy accommodation for the crowd of men employed, in some cases this want having been entirely disregarded: the result of which was a condition of things better imagined than described. There has never, however, in these instances, been any difficulty in obtaining a prompt compliance with any order of the Board. The most extensive works in the district are those of the two Gas Companies—the "New York" and the "Manhattan." They occupy together about eight squares, at different points, near the river margin; much of this space being devoted to the storage of their immense supplies of coal.

The Manhattan Company obtains water for the purification of gas from a remarkable spring, with the existence of which few persons in New York are acquainted. It is situated near the centre of the square bounded by Fourteenth and Fifteenth Streets, and Avenues A and B, and was formerly known as the "Stuyvesant Tea Fountain." The well is twelve feet in diameter, and only fifty feet deep; and supplies, by means of a steam-pump, the enormous quantity of 100 gallons of water per minute, day and night. This is conveyed to the works through a pipe several blocks in length.

Markets.—A substantial and imposing public market has just been completed between East Sixteenth and Seventeenth Streets, on the river side. It is exceedingly well drained and ventilated, and has an area of about 60,000 square feet. An extensive pier is to be connected with it; and a ferry to Long Island is projected, starting from the immediate vicinity. These improvements have given a greatly-increased importance to surrounding property, and this section is evidently about to undergo a material change for the better.

State of Health during the Year.—There has been a remarkable condition of health prevailing in the 18th Ward during the year—interrupted, however, by the general epidemic of small-pox—of which 140 cases occurred in this district. There appeared one outbreak of typhoid fever in February, at No. 407 East Eighteenth Street, involving nine cases—four being malignant, and one fatal. They all exhibited well-defined symptoms, with the exception that diarrhœa was present in only three cases. The whole of them were under the charge of Dr. G. L. Newcomb, and were treated with remarkable skill and success. The origin of this disease is, undoubtedly, to be attributed to the uncommonly wretched condition of the premises to which it was confined, every circumstance being present which might promote its development—bad ventilation, defective drainage, and abundant filth. The dwelling and yard were thoroughly cleaned and disinfected immediately; and, having shortly afterward come into possession of a new proprietor, the place was metamorphosed into quite a model tenement. Had not the most peremptory measures been adopted, the whole neighborhood would probably have become infected.

Statistics relating to Tenement-houses.

Total	number of	squares surveyed	110
"	"	tenement-houses surveyed	921
"	"	other dwellings "	2,654
"	"	stables "	427
"	"	other structures "	320
Total	number of	tenement-houses surveyed	921
"	"	families in the above	9,207
"	"	persons "	39,748
Average	"	families "	10
"	"	persons "	43
Largest	"	families in one house	22
"	"	persons "	126
Total	"	tenement-houses with water-closets	42
"	"	" " " privies	879

Taking a general view of the Eleventh Inspection District, its tenement-house portion may now be regarded as in comparatively admirable condition—even my limited period of service having witnessed vast progress therein. The population are becoming interested in the exertions put forth to mitigate the essential evils which surround them, and are beginning to show their appreciation by whatever assistance they can lend. This, of course, is the foundation of all progress in sanitary reform. What is particularly conspicuous, also, is a decided improvement in the class of owners. It will be observed, by reference to my statistics, that nearly one-fourth of all the owners reside in their own tenement-houses, which are generally kept clean on that account. The rest of the owners are mostly men of respectability, easily induced to satisfy the demands for sanitary reformation.

Respectfully submitted:

CHAS. P. RUSSEL, M. D.,
Sanitary Inspector.

NEW YORK, *January* 1, 1870.

DISTRICT No. 12.

To ELISHA HARRIS, M. D., *Sanitary Superintendent.*

SIR: I have the honor to present the following report of my sanitary labors in the Twelfth Inspection District during the past twelve months.

The Twelfth District includes that portion of the city of New York known as the 20th Ward, and is bounded north, by Fortieth Street; east, by Sixth Avenue; south, by Twenty-sixth Street; and west, by the Hudson River.

A small portion of the district is occupied by first-class residences, and the remainder devoted to retail trade, manufactures, the residences of the mechanic, the business man of moderate means, and the tenement-house population. The avenues, extending in a direction nearly north and south, are almost wholly devoted to business, the first story of each building being occupied for such purposes, the proprietors usually residing in a part or the whole of the upper portion. Many of these buildings are occupied above the first floor as tenement-houses, the owner or lessee reserving to himself the better portion, and letting the remainder to three, four, or five families, as the case may be.

The streets, crossing the avenues at right angles, vary more considerably in the style and structure of their buildings, as well as the circumstances and condition of the occupants. With the exception of Thirty-fourth Street, the better class of private houses may be seen in that portion of the district bounded by Eighth and Ninth Avenues, Twenty-seventh and Thirty-fifth Streets. The remaining portion consists of a mixed class of buildings, there being a large number of tenement-houses, among which are mingled some of the better class of private dwellings, factories, workshops, and business places of almost every description. In the northwestern corner of the district are congregated the fat-melters, gut-cleaners, and other offensive occupations, rendering the locality particularly noted for the nuisances within its limits.

The topography of the district is, with slight variations, a regular descending grade toward the south and west, the highest elevation above tide-water being at the corner of Fortieth Street and Sixth Avenue. From this point the grade is descending to the south and west as far as Eighth Avenue, where the grade is ascending to Ninth Avenue in all the streets from Twenty-ninth to Fortieth. Another irregularity is on Tenth Avenue, where the grade descends from Thirty-fifth to Fortieth Street. These constitute the principal exceptions to the general grade of the district. From Tenth Avenue the grade is gradually descending to the line of Twelfth Avenue, where the average elevation of the graded portion is six feet; though there is a large portion within this line that is not yet graded, and a considerable extent known as "water-lots," yet to be "filled in" or reclaimed from the river. Most of the ground west of Tenth Avenue, and south of Thirty-second Street, has been so reclaimed, the original bank of the river having extended from near the corner of Twenty-sixth Street and Tenth Avenue, to Thirty-fourth Street and Eleventh Avenue. Nearly all north of this point, and west of Eleventh Avenue, is "filled-in" ground. The natural water-courses, with one exception, flowed in a westerly direction, and discharged into the Hudson River; and, from near the mouth of the principal one, there extended a narrow strip of marshy ground varying from 300 to 700 feet in width, next to and parallel with the shore, from Twenty-seventh to Thirty-fifth Street. Another considerable stream took a northerly course along the vicinity of Tenth Avenue, and was bordered by a strip of marshy ground some 200 feet in width. It is in these localities, particularly the latter, that we see some of the heavy rates of summer mortality of the 20th Ward, and where deep, thorough drainage is needed, as is evinced by the damp cellars and basements occupied by the poorer classes. The principal direction of the sewer out-fall is west, though that of a portion of the sewers is not directly so. A main sewer in Eighth Avenue, which is below the level of the Seventh and Ninth Avenues, receives the contents of the cross-street sewers from both directions. At Thirty-fifth Street the grade commences to descend in both directions, north as far as the Thirty-ninth Street sewer, and south as far as the Twenty-third Street sewer, these two cross-street sewers receiving the sewage from the greater portion of the district. The street sewers west of Ninth Avenue, where the grade begins to descend toward the west, generally discharge into the Eleventh Avenue sewer, which conducts its contents into the main sewer in Twenty-third Street; and thus the river at the foot of West Twenty-third Street is made the receptacle for a greater portion of the sewage from the Twelfth, besides that from a part of the Tenth District. The Eighth Avenue sewer, being thus made the conduit for the sewage and surface-water of so large a portion of the district, is sometimes a serious detriment to the cellars and basements on the avenue, particularly between Thirty-fifth and Thirty-seventh Streets. During very heavy showers of rain, the leaders, house-drains, and street-basins, pour their contents into the sewer with such force and in such volumes, that these cellars and basements are sometimes flooded by the contents of the sewer being forced back through the house-drains, sinks, and water-closets. The too limited capacity of the house-drains to discharge readily the water received from the leaders, or the want of proper ventilation in the sewer itself, presenting an atmospheric resistance to the discharge from the house-drains, may either or both have the effect to force back the water by preventing its free discharge into the sewer. Many of these basements are occupied as stores, workshops, and dwellings, and when this accident occurs it is usually attended by more or less damage to property as well as detriment to health.

The following is a summary of inspectorial labor performed by me during the past twelve months:

Inspections and reinspections of tenement-houses	1,259
" " private dwellings	567
" " basements and cellars	100
" " packing-houses	8
" " docks	12
" " rendering-establishments, including tripe and gut cleaning, soap, candles, etc.	85
" " stables	161
" " tanneries and wool-pulling	6
" " schools	10
" " shanties	92
" " dumping-grounds and manure-heaps	16
" " slaughter-houses, including hide and fat houses	21
" " distilleries	7
" " yards, areas, etc.	15
" " open and sunken lots	13
" " factories	21
" " limekiln	1
" " cases of small-pox	22
Vaccinations	558
Inspections and reinspections of cases reported cholera	9

About the middle of May, small-pox appeared in 33d Street, between Seventh and Eighth Avenues, in some crowded front and rear tenement-houses, and had spread to several families before the fact became known to any of the Board's officers. Upon learning this, I visited the locality, called on and offered free vaccination to every family on the block. Many accepted the offer, and others were persuaded to go to their family physicians, or to the Dispensary for the necessary protection. The result of this effort was to arrest at once the further spread of the disease in this locality. About the same time the disease appeared in West 27th Street, between Ninth and Tenth Avenues, in a rear tenement-house which stands within two feet of a similar house on the rear of the adjoining lot on 28th Street, being a convenient *nidus* for the propagation and spread of the contagion. I likewise visited and offered free vaccination to the several families residing in the front and rear houses of this neighborhood, both on 27th and 28th Streets, which effort was successful in arresting any further spread of the disease on this square. The disease now breaking out anew in various portions of the city, the Board authorized the organization of a plan for a similar visitation to the entire poor and tenement-house population, for the purpose of affording gratuitous vaccination to all who would accept of it. In the Twelfth District, 1,988 vaccinations were thus effected by authority of the Board, and probably as many more by private physicians and at the Dispensaries, during the month of June. My own duties in furthering the execution of this work consisted in obtaining, inspecting, and distributing the proper supply of virus, for the details of which I refer you to the special report on the subject. I have only to add on this subject, that, since the completion of this great work (July 7th), only four cases of small-pox or varioloid have been reported from the Twelfth District.

During the summer nine cases of reported cholera were referred to me for investigation and report, four of which were fatal. Of the latter, *post-mortem* examinations were made of two, revealing the cause of death in one to be rupture of the uterus connected with criminal abortion; and in the other, ulceration and perforation of the appendix vermiformis. Of the other two, both were over sixty years of age, and had been for several years below the average standard of health. One was seized with violent purging and vomiting after returning from a picnic, and the other was taken sick in the country and brought home in that condition. Each one lived several days after the attack. Of those who recovered, all were cases of severe cholera morbus, or choleraic diarrhœa, clearly traced to some imprudence or irregularity on the part of the patient.

The above summary of inspections and reinspections includes the sanitary survey and the various responses to citizens' complaints, besides special attention to the more aggravated nuisances with which we have had to deal, most of which are congregated in the northwestern part of the district, in the form of fat-melting, tripe and gut cleaning, offal-boiling, soap-grease melting, dumping-grounds, manure-boats, and various kindred nuisances with which this locality abounds.

The portion of my district in which the sanitary survey has been completed, is bounded by Fortieth and Thirty-sixth Streets, Sixth Avenue, and the river. This survey includes not only the tenement-houses, but private dwellings, shanties, and buildings of every description. In prosecuting this survey I have adhered strictly to the blank forms prepared for the purpose, making the inquiry regarding tenement-houses complete and exhaustive.

The following is a tabulated statement of the labors performed in the course of this survey, though duties in various portions of the district, and frequent calls to the Central Office on special duty, have considerably interfered with its rapid prosecution:

Tenement-houses	429
Private dwellings	700
Shanties	92
Stables	154
Factories	18

Added to this is a large number of miscellaneous buildings not classified, including Abattoir Place, with the docks, dumping-grounds, etc., in that vicinity.

The various points of sanitary interest observed and noted in the course of this survey were: size and condition of the house, and of the unoccupied area; the ventilation, drainage, condition of cellars and basements, privies, water-closets, etc., together with various other points necessary to complete the inquiry, in the course of which the following statistics were gathered:

No. of families residing in tenement-houses	2,792
" " persons " " "	11,287
Largest number of families in a tenement-house	20
" " persons " " "	98
No. of tenement-houses with water-closets	52
" " " " " privies	377
" " " " connected with sewer	399
Smallest space in cubic feet per occupant in living-rooms	140
" " " " " " bedrooms	73
Average " " " " " living-rooms	432
" " " " " " bedrooms	297
Private-house population	5,812
Shanty "	498

Whenever, in the course of this survey, any neglect of sanitary requirements, or violations of the Tenement-house Law, have been observed, these have been promptly reported to the Board, and the respective owners or agents notified to remedy the defect or abate the nuisance without delay. In this way the law has been enforced throughout the entire portion of the district in which the survey has been completed, both as it regards tenement-houses, and the various other sanitary requirements, with perhaps a few exceptions where suits are still pending, or the necessary alterations in the course of completion.

It has also been my practice, in responding to a citizen's complaint in any portion of the district, to not only investigate the specific cause of complaint, but, if a tenement-house be the subject, it has been thoroughly inspected with reference to its conformity or non-conformity to the Tenement-house Law; and in this manner a large number of tenement-houses have been put in the required condition outside of that portion of the district in which the sanitary survey has been completed.

The results of my experience, in applying the improvements required by the Tenement-house Law, have been eminently satisfactory. The subject of ventilation alone and the improvements made therein have received full attention, and contributed largely to the comfort and cheerfulness of tenement-house occupants. This is seen in the diminished amount of sickness and mortality in tenement-houses since these improvements have been introduced. It is seen in the expressions of satisfaction and gratitude with which the inspector is greeted at his final visit for reinspection regarding the extent and character of the improvements made. It is also seen in the increased willingness on the part of owners to not only comply with the requirements of the law, but to do whatever may be necessary for the welfare and comfort of their tenants. As a foul atmosphere and filthy surroundings not only beget physical disease and death, but also tend to degenerate the moral and intellectual status of those constantly exposed to such influences, so will pure air, uninterrupted sunlight, and cleanliness, conduce to improve the health, increase the physical as well as the moral and intellectual energies, and thus, to a certain degree, elevate the entire condition of the tenement-house population. Owners are beginning to appreciate this fact, and hence are not only willing to comply, but often manifest an anxiety for information concerning the spirit and requirements of the law, without waiting for a formal notice from an officer of the Board. By this course they not only comply with the law and thus escape its penalties, but by improving the condition of their tenants, morally as well as physically, they prepare the way for a more speedy and available income from their investments. The same is true in regard to improvements in drainage, cleanliness, and repairs. Whatever effort is made to render tenant-houses cheerful and attractive, will, in a large majority of cases, develop a responsive effort on the part of the occupants, not only in regard to the condition of their domiciles, but to a like improvement in their own personal habits, and every thing that tends to elevate them in the scale of humanity. I have seen this result in repeated instances, as shown by more thorough scrubbing of the floors, the more frequent whitewashing of the walls and ceilings of the apartments, the greater care in disposing of the garbage, and the more cheerful and tidy appearance of the tenants themselves. It must be confessed that there are some so degraded as to defy every effort looking toward the amelioration of their condition; but these constitute the exception rather than the rule, and should not retard the work of improvement.

The necessity for these improvements may be seen by glancing over the sheets containing the records of the sanitary survey, particularly the columns in which are recorded the items of cubic space in the living and sleeping rooms. It is now generally conceded that each individual should enjoy a well-ventilated space of 1,000 cubic feet, or the constant supply of 10 cubic feet of fresh air per minute; and hence the necessity for making use of all available means of affording the best possible methods of ventilating these pent-up apartments is apparent; and, moreover, the actual improvement in the condition of the occupants of those houses which have undergone the required alterations, and the marked change which the Inspector perceives in the condition of the atmosphere of the apartments, are fully demonstrative of the wisdom of this section of the Tenement-house Law, and the necessity for its enforcement. Lighting, cleaning, and house-drainage, are also matters of vast importance to tenement-houses. Very few of the tenement-houses in my district, particularly the halls and middle bedrooms, are sufficiently lighted. In a few instances, the ventilating shaft, with which the bedrooms have free communication by means of large windows, improves them a little both in light and ventilation. But even this affords no direct sunlight, so important to a high degree of sanitary excellence. The upper halls, by means of sky-lights or windows, receive more or less of the sun's rays at certain hours of the day, and give an air of cheerfulness to the entire floor. House-drainage is also receiving much more attention than formerly. Unless the sink waste-pipes are properly supplied with traps, offensive odors are constantly escaping therefrom, and contribute not a little to the insalubrity of the apartments. The sewer-pipes are also better constructed and far less offensive than were the old brick or wooden drains, that were constantly getting out of order and allowing offensive odors to escape, impregnating the house with sewer-gases, to the great annoyance of the occupants.

There is not so much overcrowding of tenement-houses in my district as in some of the lower wards, neither do we find the close packing of houses so general. There are, however, some localities where a square, or a portion of a square, is occupied by four solid rows of front and rear tenement-houses, the latter standing "back to back," or with perhaps a narrow space of two feet or less between the rear walls, which is usually the receptacle for the various cast-off and refuse matter which is thus disposed of in the most convenient manner. These narrow spaces often become filthy and offensive from this cause, and from their narrow limits, rendering it often difficult if not impossible to clean them, they may be regarded as among the permanent nuisances in connection with rear tenement-houses. These rear houses however, generally have the advantage of through-ventilation, and have no rooms that do not communicate directly with the external air, which compensates in part for the fault in location.

Frequent and thorough cleaning of the interior of these domiciles constitutes another important sanitary measure, though one more difficult to enforce than most of the other provisions of the Tenement-house Law. The stairs, hall floors, as well as those of the apartments, the walls, ceilings, and standing wood-work, need constant attention in order to free them from the various animal exhalations with which they become saturated. The section of the law which requires landlords to whitewash the walls and ceilings of the halls twice a year, is a step in this direction, and often begets a spirit of emulation on the part of the tenants, resulting in more attention to cleanliness through the entire house. Where a tenement-house is under the care of an efficient superintendent, residing on or near the premises, and held responsible for its condition, as well as that of the cellar, privy, garbage, etc., we find much less cause for complaint than where there is no such supervision; and, could some such regulation be adopted and enforced among all large tenements, it would contribute largely to the comfort of the tenants, preservation of the property, and health of the city.

Neglect of privies is the most aggravating nuisance in connection with tenement-houses, making the atmosphere thereabout offensive and disgusting, impregnating it with the germs of disease, and rendering those who inhale it peculiarly susceptible to typhoid and epidemic influences. Next to ventilation, it is in this direction that the Board has effected the greatest number of radical reforms. The old-fashioned privy-vault, made by digging a hole in the ground, and walling it up with loose stones, through which the fluid contents escape to percolate through the soil, to poison the springs, and by exhalation to impregnate the atmosphere with the elements of disease, is now the exception rather than the rule, and is, in most instances, replaced by water-tight vaults constructed of brick and cement, connected with the sewer by stoneware drain-pipes, and flushed by waste-water from the hydrant, and rain-water from the yard and roof of the house. A few of the better class of tenements are provided with water-closets, which are preferable where the people are sufficiently intelligent and use the proper precautions. If, however, ignorance and vicious inclinations prevail, or children are not properly instructed and controlled, they become a more intolerable nuisance than the privy-vault with its accumulated mass of filth. But neither the privy-vault nor the ordinary water-closet is well adapted to the wants of the occupants of a large tenement-house. The latter, unless proper precautions are used, frequently becomes offensive by obstructions lodged in the traps or sewer-pipes, when the hopper becomes full to overflowing; and the former is always offensive from the accumulation that cannot pass off by the sewer-drain in consequence of a regulation of the Croton Board which requires the drain to be placed a certain distance above the bottom of the vault. In making sewer connections with these privy-vaults, there is no uniformity in the distance observed between the bottom of the vault and the outlet, one builder making it two, and another six feet, leaving the space below the outlet to be filled with fecal accumulations, which there undergo fermentation, and generate noxious gases to be given off in suffocating volumes whenever the mass is agitated by the copious discharge from a leader during a heavy shower of rain.

The "school sink," which consists of a long iron tank, with an outlet at one end, secured by a plug, and a hydrant, or draw-cock, for the supply of fresh water at the other end, is, in my opinion, far less offensive than the privy, and more easily managed than the water-closet. In order, however, to best secure success, and prevent obstructions, it should be under the care of one person only, who should daily, or oftener if necessary, withdraw the plug, and allow the contents to escape. The plug is then replaced, a supply of fresh water introduced, and the tank is ready for use during the next twenty-four hours. The plug and draw-cock should both be secured with a key, to prevent any save the proper person interfering with them. We thus alike guard against any improper substance entering the sewer-pipe, and the overflowing of the tank. In public schools, factories, and hospitals, wherever these tanks have been introduced, they have proved to be far preferable to the privy-vault or the water-closet; but what is most needed is, some simple and inoffensive means for preserving and adapting our excrements to the demands of our agricultural interests. Taking the valuation that English agriculturists place upon human excrements—ten shillings sterling per annum for each individual—and our own estimated population of 1,000,000 human beings, including temporary visitors, we have an item of 500,000 pounds sterling per annum, most of which is discharged into our rivers, to pollute their waters, and render our beautiful bay one great cesspool of filth. This is not only a great nuisance to us, but it robs our agricultural districts of their just dues. They are annually pouring in upon us their choice productions, loaded with the vital elements of the soil, all of which is wasted, instead of being returned to the soil, to invigorate and repair its wasted energies. The "earth closet" appears to be a step in the right direction, but its general adoption seems hardly practicable in so large a city as New York; and the field may be regarded as still open to competition in the effort to accomplish this desirable object. In this respect we are far behind the teachings of the great Hebrew lawgiver and sanitarian, who wrote: "Thou shalt have a place also without the camp, whither thou shalt go forth abroad; and thou shalt have a paddle upon thy weapon; and it shalt be when thou wilt ease thyself abroad, thou shalt dig therewith, and shalt turn back and cover that which cometh from thee."

The neglect of stables is another source of annoyance to those who live in their immediate vicinity. There are several large stables in the Twelfth District, most of them defective in some point regarding their sanitary condition. The manure from these stables is usually kept in vaults under the sidewalks, until it undergoes a partial fermentation, when it is removed in carts, yielding at the time a most offensive odor. As the means of deodorizing stable-manure are simple, and entirely within our reach, I would suggest that some system be adopted that will secure their regular application, both to the manure and to the stables; and thus relieve our citizens of one great annoyance.

In most of the streets in the Twelfth District we still meet with the old cobble-stone pavement, in many places very uneven and filthy. Some portions of Twenty-seventh and Twenty-eighth Streets, and Thirty-eighth and Thirty-ninth Streets, are nearly always very filthy with garbage, the gutters uneven, and filthy with house-slops, and the depressions in the street-pavement full of stagnant water. In many of these places there are complaints that the ash-men are not regular in their rounds; and hence the frequent accumulations in the streets and gutters, and on the sidewalks. Some system that will insure the speedy removal of the ashes, garbage, and other filth, from our streets, is at present a great sanitary want; as is also a copious supply of water for the frequent flushing and washing of the sidewalks, street-gutters, and pavements. When garbage is allowed to accumulate, particularly in warm weather, it soon begins to ferment, and becomes highly offensive, the odor remaining for some time after the mass is removed; and hence in many of our tenement-house neighborhoods this offensive odor is always present, though from time to time the streets may be tolerably clean, the odor remaining for want of sufficient flushing and deodorizing.

The Twelfth District contains a large number of establishments where offensive occupations are carried on, among which may be mentioned fat-rendering establishments as the most prominent. Ever since the organization of this Board, frequent orders have been served on the men engaged in this occupation, requiring them to so conduct their operations as to prevent the escape into the atmosphere of all offensive exhalations. From time to time various improvements have been introduced for the purpose of bringing about this result; and the effect has been to mitigate the evil, though the nuisance still continues to a considerable extent. None of the improvements thus far introduced have accomplished the desired object, and I think the Board will finally be under the necessity of causing the removal of all engaged in this business to some place where concentration will afford the erection of suitable machinery by means of which the business can be conducted without offence.

The nuisance of manure-dumping still continues to a considerable extent, notwithstanding the frequent arrests and fines imposed upon men engaged in this business. A want of sufficient means for removing manure from the city in proportion to its production, is the only excuse made for the occupation of these dumping-grounds. Such being the case during the winter, I would recommend that large sheds be erected on these dumping-grounds, under cover of which the surplus manure may be stored to await the increased facilities for its removal. This would not only mitigate the nuisance, but, by preventing the free escape of its most useful element (ammonia), would render the manure far more valuable as a fertilizing agent.

My three and a half years' experience as Sanitary Inspector has afforded me ample opportunity to witness the gradually-increasing favor with which the requirements of the Board are from time to time received, and to compare the readiness with which most of its orders are now complied with, with the opposition which characterized the early days of its administration. To perfect the operations of an executive department of so great importance, requires a course of education derived only from experience, to enable the Commission to discharge its duties wisely, and an increasing intelligence to enable the public to justly appreciate its actions. This, I believe, would be the result of the continuance of the present system of health laws, and would in time perfect the development of a wise sanitary government.

Respectfully submitted:

E. H. JANES, M. D., *Sanitary Inspector.*

NEW YORK, *October* 30, 1869.

Appendix to Report on the Twelfth District.

Since the foregoing Report was written, the sanitary survey of the Twelfth District has been completed, the following being a brief summary:

Tenement-houses	1,542
Private houses	2,649
Shanties	115
Factories and workshops	221
Stables	460
Families residing in tenement-houses	8,775
Persons " " "	40,993
Average number of families to a tenement-house	5.81
" " persons " "	25.58
Largest " families in a tenement-house	24
" " persons " "	192
Number of tenement-houses with water-closets	118
" " " privies	1,424
" " having no sewer-connection	44
Shanty population	390
Melting-houses	9
Slaughter-houses	3
Hide and fat houses	3
Packing-houses	6

Respectfully submitted:

E. H. JANES, M. D., *Sanitary Inspector.*

January 27, 1870.

DISTRICT No. 13.

E. Harris, M. D., *Sanitary Superintendent.*

Sir: I have the honor to submit the following report of my labors in the Thirteenth Sanitary District, extending over a period of seven weeks, and in that portion of the city bounded by Twenty-sixth and Fiftieth Streets, East River, and Sixth Avenue, being a part of the 21st and 19th Wards.

The general sanitary condition of the district is good.

There are very few contagious diseases comparatively. The spontaneous development of typhoid fever in this city seems to be on the increase, and it will doubtless take the place of miasmatic diseases, which are gradually becoming eradicated, as the city becomes more thoroughly sewered and drained.

Third Avenue is fast becoming the great centre of travel and trade in this part of the city, It has already become the dividing line between the rich and poor inhabitants.

That portion of the district west of the avenue is mostly built up with first-class houses, and occupied by private families.

That portion east of the avenue is mostly built up with tenement-houses and manufactories.

The highest elevation of land in the district above tide-water is at Fortieth Street and Madison Avenue; the lowest above tide-water is at Thirty-fourth Street and First Avenue.

Some parts of the streets and avenues need cleaning very much, especially in First Avenue, near Thirty-second and Forty-sixth Streets. People who live in those neighborhoods inform me that the filth is scraped up in heaps about once in six weeks, but has not been removed in carts for the past year.

There is a general disposition on the part of the owners of tenement-house property to comply with the requirements of the Board.

The fact has now become very firmly fixed in the minds of a majority of the inhabitants of the district that the offensive nuisance of fat-boiling should be removed beyond the city limits.

The disposition in the minds of the lower classes of the district to improve their hygienic condition is manifestly increasing, and, with the continued assistance of the Board, their comforts in life will be very much improved.

Statistics of the Tenement-House Sanitary Survey.

[The records of the Thirteenth and Nineteenth Districts are here combined, and comprise the 21st Ward, and that portion of the 19th Ward lying south of Fiftieth Street.]

Total number of tenement-houses surveyed	1,240
" " families residing in them	7,973
" " persons " "	34,117
Average number of families in a house	6.43
" " persons "	27.50
Largest " families "	23
" " persons "	93
Total number of tenement-houses with water-closets	64
" " " " privies	1,176
" " private dwellings	4,324
" " shanties	408
" " manufactories	37
" " market-stands	55

Total number of stables	305
" " other structures	239

Respectfully submitted,
J. W. ROBIE, M. D.,
Assistant-Sanitary Inspector.

NEW YORK, *January* 1, 1870.

DISTRICT No. 14.

ELISHA HARRIS, M. D., *Sanitary Superintendent.*

SIR: In conformity to your request, I submit the following statistics, etc., of the sanitary survey of the Fourteenth Inspection District up to the date of my resignation:

Area surveyed.—From Sixth Avenue to the North River, and between Fortieth and Forty-third Streets. Also from Sixth to Eighth Avenues, between Forty-third and Forty-fifth Streets.

(1.) Number of tenement-houses	356
(2.) " private dwellings	791
(3.) " other structures	177
(4.) Entire population	15,700
(5.) Residents in tenement-houses	9,651

(1.) *Greatest Density.*—The largest number of tenement-houses situated upon one square is fifty-one—the square bounded by Ninth and Tenth Avenues, Fortieth and Forty-first Streets. There are two squares upon which no tenement-house is situated, and four squares having each but one tenement-house.

The general character of these houses is good. The largest (423 West Forty-first Street) contains sixty-four families, being a model house; a limited number contain from sixteen to twenty-four families, while the greater number contain the minimum of four families, are owned by one of the occupants, and kept in good condition.

Average Size of Tenement-Houses.—The average number of families to each tenement-house has been ascertained to be six.

In most respects these houses have been brought to comply with the letter of the Tenement-house Law, the difference in their condition depending on (*a*), the character of the buildings; (*b*), the care of owner or agent; and (*c*), the class of occupants.

(*a.*) The tenement-houses are mostly of wooden construction, and of a nature admitting of modifications for compliance with the law.

(*b.*) With the larger houses, the plan of employing a housekeeper or a resident-agent has been tried in a few cases, and with gratifying results—e. g., Nos. 423 West Forty-third Street; Forty-first Street, between Seventh and Eighth Avenues; Higgins's houses in Forty-third Street, etc. The smaller houses, often partly occupied by the owner, are in good order.

(*c.*) The houses occupied by persons of German nationality are, as a rule, in good condition.

Houses occupied exclusively by Irish are, as a rule, in poor condition.

Where all the floors of a house have been let, each to a number of families at a small rent, there is found to be not only personal uncleanliness, but also a rapid deterioration in the good repair and cleanliness of the house. Next to the employment of housekeepers, the best plan, both for the public and for the preservation of property, seems to be the letting of whole floors, half floors, and smaller suites from below to the top, at varying rents according to desirability. The aggregating of a number of dirty and ignorant people is thus prevented; the intelligent educate the more ignorant; cleanliness is encouraged; and the house kept in repair.

The success in ventilating the tenement-houses has been very satisfactory. Few houses remain which have not adequate hall and bedroom ventilation, secured by efforts of the inspectors, who have insisted upon ventilation as the most essential and immediately-practical feature of the sanitary work.

Sewer-Connection.—Less success has attended the endeavor to secure general sewer-connection, and protect the air from contamination of exhalations from privies, waste and soil pipes. Expense of sewer-connection, short period of lease, transfers of property, unsettled estates, doubtful titles, etc., are the grounds, real and assumed, upon which, in most cases, the construction of perfect systems of house-drainage is obviated.

Privy-Vaults.—The filling up of all privy-vaults, and the discharge of all fecal matter into the sewer, will greatly reduce the total of diseases common to tenement-houses. It only remains to devise some form of water-closet which can be used by the ignorant, easily cleaned, secured from choking by garbage, etc., and not liable to leak or overflow.

Water-Closets.—In some houses water-closets have been placed in the cellars, areas, etc. This is a bad plan, as they are less thoroughly ventilated, dark, and therefore dirty, and being removed are inconvenient and liable to be broken and soiled by children. The location of water-closets on each floor, adjoining the hall window, with light and air, and leaving the responsibility for its cleanliness and repair upon the occupants of the floor, seems to have attained the best results. In the model house, No. 423 West Forty-first Street, there are eight water-closets on each floor, thirty-two in all, being one to every two families.

Garbage.—My observation has led me to believe that, were there no irregularity in the collection of garbage by the authorities, little trouble would be experienced from this source; and that the habit of throwing ashes and garbage into the street has arisen from the irregularity with which they are collected, the long period during which receptacles remain full, and the unwillingness of the cartmen to remove matter of an offensive nature, or which may have been spilt into the gutters. The prompt and regular daily removal of ashes and garbage, and at a morning hour, would induce a habit of cleanliness, and render the consideration of the subject of special forms of garbage-boxes, etc., unnecessary.

(2.) *Private Residences.*—The private residences of this subdistrict are, for the most part, in excellent sanitary condition, including in their number many of the finest dwellings in the city, a large number of ordinary residences for single families, and not a few which come just within the legal definition of a private dwelling—having but three families. As, in most of such cases, at least a floor is secured to each family, through-ventilation is obtained and the suites are healthy.

Shanties.—An exception, under the head of "private dwellings," and one of grave importance, must be made concerning the "shanty" dwellings. They constitute, as a class, the most unwholesome and dangerous abodes of the district. Although their occupants, as a class, are hardy, and, during a favorable summer like the past, remarkably free from disease, yet there exist in them a fruitful source of acute disease, a ready field for epidemics, and a focus for the breeding and extension of contagions. From a moral stand-point, a careful investigation has shown that a large community is existing, not only in utter disregard of all hygienic rules, but also immersed in a corresponding social and domestic atmosphere, which renders it the resort of the most desperate and abandoned criminals. The dispersion of such a community not only removes a source of disease and one of the most flagrant violations of sanitary law, but also scatters a mass of individuals, who, if aggregated, grow confirmed in vice, but, separated, would be placed under beneficial influences and saved from degradation and crime. Such an action is needed no less than was the destruction of the original "Five Points."

(3.) *Structures other than Dwellings.*—1. The works of the "Metropolitan Gas Company," at the foot of West Forty-second Street, claim especial attention. During my term of service they have given little cause for complaint. At one time coal-tar and ammoniacal water were poured upon the dock and into the river, but this was discontinued by order of the Board.

2. *Horse-Stables.*—The Fourteenth District contains an unusually large number of stables—for private use or for corporations. In the subdistrict of my survey, the largest is that of the Forty-second Street horse railroad, located at the foot of Forty-second Street, and accommodating 400 horses. Like the Eighth Avenue stable, of more than twice its capacity,

it is well constructed and not liable to public complaint. The lesser stables, consisting of distinct buildings or located in vacant lots or rear yards, seem to have exerted no unfavorable influence upon the local healthfulness. In nearly every instance I have made special inquiry as to the health of residents in and around stables, and of the ratio of disease, especially of febrile disease, diphtheria, etc. Where the community is built up, the frequent removal of manure is practised of necessity, for want of storage-room, and the exhalations from fresh manure have not been found insalubrious.

3. *Cow-Stables.*—No cow-stables of any size exist in the subdistrict. One at the foot of Fortieth Street contains six cows, one in Forty-third Street seven cows.

4. *Cattle-Pens.*—The cattle-pens at the foot of Fortieth and Forty-first Street are offensive only as the source whence swine, etc., are driven through the streets of the district. The pens in themselves are clean and well conducted, and the surrounding population is sparse.

5. *Slaughter-Houses.*—These are, almost without exception, conducted without regard for the public, and seldom more than barely complying with the law, the business being conducted in buildings of a temporary structure, on leased ground, etc., which are inadequate and permanently open to complaint. The best establishment, White & Co.'s pork-slaughtering-house, at the foot of Fortieth Street, has defective sewerage, so that, at low tide, blood, offal, viscera, etc., are liable to be strewn over a vast area of mud in the basin between the Fortieth and Forty-first Street docks.

Two large packing-houses on Eleventh Avenue also try lard, and emit most unwholesome vapors.

The slaughter-houses at Tenth Avenue and Forty-first Street all have filthy and undrained cattle-yards in the rear.

Donohoe & Son, Fortieth Street and Ninth Avenue, habitually keep rancid fats upon their premises, to the annoyance of the neighborhood.

The only remedy for the slaughter-house nuisance is its entire removal from the city. The endeavors of the Board to inculcate principles of hygienic and sanitary science are thwarted by the prolonged existence of these more palpable nuisances in defiance of their power.

(4.) The entire population of the subdistrict has been computed to be 15,700.

(5.) The tenement-house population and the occupants of shanties have been counted. The population of private houses has been estimated upon a knowledge of the number of families.

6. *Sewers.*—There is no street in the subdistrict where a sewer does not exist or is not in progress. For the most part they have a gradual descent from the centre of the island to the North River, and are well built and in good order. The large stone sewer, from the Croton Reservoir, passing through Forty-second Street, is a most effectual outlet for the sewage of this part of the district. The sewers of Forty-first and Forty-second Streets empty above the level of the tide, and the basin is often an expanse of offensive matter.

7. The water-side presents no features other than in connection with the subject of sewers.

8. Sunken lots, of which a number exist, have been the source of sickness and complaint in three instances (none, however, in the subdistrict). I mention them as a part of the general sanitary work. The lots between Fifty-third and Fifty-fourth Streets on Tenth Avenue, west side, were the source of much complaint, both by letters to the Board and in the public prints. They were filled with standing sewage-water, and became very offensive and unhealthy. The lots were subsequently partially drained, disinfected, and filled in by the Board.

The lots on Fifty-sixth Street and Tenth Avenue, in the rear of Schaeffer's Brewery, were filled with sewage of houses, brewery, privies, etc.; owing to imperfect street sewerage, the nuisance is liable to recur.

An excavated cellar for five houses, on Fifty-eighth Street and Eighth Avenue, was filled with putrid water, rendering houses in the rear, on Fifty-ninth Street, uninhabitable.

On the subjects of small-pox and vaccination, as a part of my service, I desire to include the reports previously made and in the possession of the Board; first, of the prevalence of small-pox on "*Fifty-fourth Street Rock*" (Fifty-fourth Street and Sixth Avenue), in the early spring, and, second, of the work of vaccination, from house to house, and in the public schools, as performed by myself with the aid of associates.

Respectfully submitted:
E. D. HUDSON, Jr., M. D.,
*Assistant-Sanitary Inspector.**

DISTRICT No. 14—CONTINUED.

E. Harris, M. D., *Sanitary Superintendent:*

I beg leave to submit the following report relative to the district under my charge for the period of two months and twenty-six days, that is, from the 5th day of August last, at which time I entered on my duties as Assistant Inspector, to the present date.

My district, the Fourteenth, comprises the southern half of the 22d Ward, and is bounded on the north, by West Fifty-ninth Street; east, by Sixth Avenue; south, by West Fortieth Street; and west, by the Hudson River.

No considerable portion of the district is occupied exclusively either for purposes of trade, commerce, etc., on the one hand, or by tenements or private residences on the other.

The larger manufactories, iron-founderies, slaughter-houses, pig-yards, pork-packing, and fat-melting establishments, predominate on Fortieth and Forty-first Streets, and in part of the Tenth and Eleventh Avenues. The avenues, however, for the most part, are occupied by frame and brick tenement-houses, with stores on the ground floors. The cross-streets between Forty-second and Fifty-ninth Streets are occupied by a large number of private dwellings, interspersed with many clusters of shanties, tenement-houses, and vacant lots. Some portions of the district above Fifty-sixth Street, west of Tenth Avenue, are as yet unoccupied, but the building of first-class residences and tenement-houses has progressed so rapidly of late, that it is fair to assume, if improvements continue to be made with the same rapidity as during the past few months, that the whole district will soon be entirely built up.

The most densely-inhabited blocks are located between Fortieth and Forty-sixth Streets, Broadway, and the North River. All of these have been surveyed by my predecessor, Dr. E. D. Hudson, Jr., and myself, and the particulars noted as required by the printed forms, which need not be here recapitulated in detail.

Every part of the district has been kept under constant supervision, and a great deal of time and labor have been devoted to the inspections and reinspections of tenement-houses, dwellings, shanties, manufactories, slaughter-houses, stables, sunken lots, streets, sidewalks, and gutters, establishments for fat-melting and soap-boiling, cellars, waste-pipes, and privies, and to visiting cases of small-pox, typhoid fever, etc.

The following is the summary of the inspections made by me:

Tenement-houses	258
Private dwellings	150
Shanties	89
Slaughter-houses, fat-melting establishments, manufactories, and other places of business	120
Horse and cow stables	85
Streets, sidewalks, and gutters, sunken and vacant lots	56
Public buildings	5
Cellars, waste-pipes, and privies	76
Markets	2
Gasworks	1
Cases of small-pox visited	5
" " typhoid fever	5

Consolidated statistics of tenement-house survey:

Total number of tenement-houses surveyed	120

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* Dr. Hudson's resignation having taken effect August 1st, Dr. Tauszky succeeded him. The statistics of the district survey follow in the report by the latter officer.

Total number of families residing in them	958
" " persons residing in them	4,796
Average number of families in a house	8
" " persons in a house	35
Largest number of families in a house	16
" " persons in a house	74
Total number of tenement-houses with water-closets	16
" " " " " privies	104
" " " " " privies sewer-connected	72

It is truly gratifying to me to be able to report that the improvements made in the tenement-houses in this district have been in the highest degree beneficial, and that the labors of the Board are duly appreciated. I have been received, without an exception, with kindness and civility by all those with whom my official relations as an officer of the Board have brought me in contact, which, together with the readiness with which the health laws are now generally complied with in this district, may be regarded as evidences of the justice, fairness, and beneficial results of these laws, which have contributed so much toward diminishing the death-rate among the poorer classes of the community, and have added materially to the care and preservation of their health.

The requirements of the Tenement-house Law are now fully understood by most of the owners and other persons having charge of the houses, and, as I stated, are now more readily complied with than when I entered upon the discharge of the duties of my office. Ventilators are still being inserted in many houses where these were wanting, the bedrooms are made more comfortable by the addition of windows; leaky roofs are being repaired, broken stairs and steps are put in order, sewer obstructions are removed, foul and unhealthy cellar habitations have been vacated, the process of whitewashing and cleaning is more generally attended to, and the hydrants, yards, halls, and alleys, are placed in a decidedly better sanitary condition, since the Tenement-house Law went into effect.

At many points in the Fourteenth District, a number of shanties are situated, which usually consist of but one room, used as the living, sleeping room, and kitchen, at the same time. The most of these are in a sadly-neglected condition. The most destitute, ignorant, and degraded classes of our population reside in them, without the least regard to cleanliness, or the observance of the elementary laws of hygiene. They have no privy nor sewer, and the ground around them is generally filthy with garbage, slops, and animal excrements. They keep a number of dogs, fowls, goats, and occasionally horses and cows, on the premises. If the occupants were ordered, as you recommended to the Board, I believe some time ago, to seek other places of habitation, their moral and sanitary condition would certainly thereby be materially improved.

One of the most important topics which could engage the attention of the hygeist is certainly that of devising the proper means of ventilation in the habitations of the poorer classes of the city, and, in my opinion, no law is more salutary in its effect than Section 2 of the Tenement-house Law, which provides that each bedroom, which does not communicate directly with the external air, shall have a ventilating window over the door leading into the adjoining room, if such adjoining room communicates with the external air, and also a ventilating window communicating with the hall or entry of the house, etc., and that every tenement-house shall have in the roof, at the top of the hall, an adequate and proper ventilator.

It requires no argument to prove that, wherever this elementary law is violated, and that persons continue to reside in ill-ventilated rooms, the deterioration of the blood, and the consequent impairment of their health, are sure to follow.

The few cases of typhoid fever which it has been my duty to visit, occurred in the tenement-houses 583 Eleventh Avenue, and 240 West Fifty-second Street, where by actual measurement I found the pro rata allotment of air-space per occupant in the sleeping-rooms to be only 120 cubic feet, whereas, according to the experiments of Mr. Coathupe, about 266⅓ cubic feet, or 460,224 cubic inches of air pass through the lungs of a medium-sized man in twenty-four hours. This want of a sufficiency of pure air, together with the neglected state of drainage, and the offensive exhalations emanating from the privies, I consider the principal causes of the affection under which the persons attacked were laboring.

The greater mortality in cities as compared with that of the country is attributable in a great measure to the neglect of furnishing the inhabitants of tenement-houses with the necessary amount of oxygen, and providing means in their habitations for the escape of vitiated air. Cholera infantum kills thousands of children who breathe the carbonic acid and other impurities of crowded tenements. Typhus fever, cholera, and other epidemic diseases, claim their many victims, chiefly in prisons, on board of crowded ships, and wherever ventilation is neglected. These well-established facts furnish the most striking evidences of the necessity for the enforcement of the law concerning ventilation.

The slaughter-houses and fat-melting establishments are conducted in a manner to give less cause of complaint than formerly. They have the proper sewer connections, and are frequently whitewashed; the cattle-pens are washed out daily, and disinfectants are freely used. I am, however, of opinion that it is impossible to conduct the business of slaughtering and fat-melting on a large scale in the built-up portion of the city, so as not to be detrimental to health. Our railroad and steamboat facilities for communicating with the surrounding country are such that no great inconvenience could arise from discontinuing the business in the city altogether.

The nuisances that give rise to complaint in this district are:

1. *The Neglect of Privies.*—Many of these are too shallow, and are either not connected with the sewer, or, if connected, obstructions exist, which prevent the night-soil from being carried off into the main sewer. The flushing of these places, from the hydrants or the leaders from the roof which carry the rain-fall into them, is often found faulty. Wherever this state of things is found to exist, a complaint is made to the Board, and the evil is promptly remedied.

2. *Stables.*—The number of stables in this district is greater than in any other in the city. Of these the largest are owned by different railroad companies, and are in a fair condition. Many of the butchers, grocers, and milkmen's stables have given rise to complaint. The manure is often found in these places scattered all over the yard, and is allowed to accumulate, until it becomes very offensive from the ammonia arising from it. The deleterious effects of this neglect of cleanliness and proper drainage, I have seen in the loss of appetite, irritation of the organs of respiration, and decline of strength in the animals kept in these filthy places, and, of course, the same causes act injuriously on the health of the persons residing on or near the premises. It seems to me that, if such animals must be kept in the city in close proximity to dwellings, the stables should be properly paved, drained, and sewer-connected. The plank floors now in use in most of them allow the urine to run through and form a pool beneath, which continually sends up noxious odors, greatly annoying and injuring those residing in the vicinity.

Where stables are not properly paved, drained, and connected with the sewer, the use of them as such should be prohibited by law.

3. *Cellars and Courts.*—These are in many instances used by tenants as depositories for ashes, garbage, and filth, and, where the sewer is obstructed, or water-pipes running through them are out of repair, they become damp and unhealthy.

4. *Neglect and Exposure of Garbage.*—The removal of garbage and ashes is done in the same unsatisfactory manner as heretofore. Occupants of buildings are still obliged to deliver them in the streets, which are consequently encumbered with numerous and overflowing boxes, barrels, and pans. This evil could be remedied by compelling the owners of tenement-houses to have the receptacles for receiving garbage and other refuse matters placed in the yards, instead of in the street, and have the latter daily removed as the Board of Health may direct.

5. *Filthy Streets and Want of Thoroughness in Cleaning.*—I must say, in justice to the Street Contractor, that the streets are swept regularly once a week, and as thoroughly as their construction or state of repair permits. Many of them are as yet unpaved; in others there are deep excavations where water and filth accumulate, and these cannot be thoroughly cleaned.

6. *Offensive Animal Refuse, Fat-boiling, Faults, and Improvements.*—Offensive animal refuse is found in some of the slaughter-houses. As long as the business of slaughtering is permitted to be carried on in the built-up portion of the city, it will be difficult to prevent the noxious gases emanating therefrom from vitiating the surrounding atmosphere. Where fat is boiled in open kettles, the stench arising from this kind of business becomes sometimes intolerable, and, as in the case of other impurities, greatly impairs the health of residents in the neighborhood of such premises. But, when the business is carried on in steam-tight tanks, as is the case with the greater portion of such establishments in this district, they occasion far less cause of complaint.

7. *Sunken Lots, Wet Grounds, Deep Drainage.*—Sunken lots are too numerous in this district to be referred to in detail here. Many of these were formerly used as dumping-grounds, but this practice has been discontinued. The most offensive of these lots have been filled up by order of the Board of Health, yet a great many remain that require to be put on a level with the surrounding grounds. Deep drainage, wherever practicable, has always been insisted on. Sewers are being constructed in Forty-second, Forty-fourth, Forty-eighth, Fiftieth, and Fifty-fourth Streets.

Among the poor classes the ignorance of the elementary principles of hygiene is truly deplorable. This remark refers especially to the inhabitants of shanties, cellars, and the more crowded tenement-houses. The more intelligent portion of the community, however, take a lively interest in the efforts made by the Board of Health. The willingness with which they comply with the requirements of the health laws is the best proof of this.

Chief Points of Sanitary Improvement.—What are the most urgent sanitary wants in the district? The chief points are deep and thorough drainage, filling up of sunken lots, the construction of sufficient and adequate street sewers, paving and repairing the streets.

The most urgent sanitary wants of the district are the removal of the shanties, slaughter-houses, and fat-melting establishments, an improvement in the management of the stables, and a more adequate supply of water for the sinks and sewers, together with the paving of unpaved streets, and the repairing of such as need it.

Should these improvements be attended to, and the health laws continue to be energetically carried out, we may soon be relieved from epidemic diseases, and render the city of New York one of the most healthful in the world.

Statistics of the Tenement-House Survey.

Total number of tenement-houses surveyed	945
" " " families residing in them	6,278
" " " persons " " "	25,896
Average number of families in each house	6.50
" " " persons " "	27.01
Largest " " families " "	64
" " " persons " "	317
Total with tenement-house water-closets	72
" " " privies	873
Total number of dwelling shanties in the district	704

Respectfully submitted:

R. TAUSZKY, M. D., *Assistant-Sanitary Inspector.*

NEW YORK, *November* 1, 1869.

DISTRICT No. 15.

ELISHA HARRIS, M. D., *Sanitary Superintendent.*

SIR: I have the honor to submit herewith my report of the sanitary condition of the Fifteeth Sanitary District, and the work done in the same during my period of service as Assistant-Sanitary Inspector, commencing January 21, 1869:

This district extends from Fiftieth Street on the south to Eighty-sixth Street on the north, and from the Sixth Avenue to the East River, being a portion of the 19th Ward, embracing a surface of very marked topography, and containing within its limits every extreme of metropolitan life.

The larger portion of the district is occupied by dwelling-houses; trade and commerce being confined to the First, Second, Third, and Fourth Avenues, which traverse the district from north to south.

The highest elevation is attained at the intersection of Madison Avenue with Seventy-second Street, and the lowest at tide-water.

The main outlets of sewerage are at Forty-ninth, Sixty-first, and Seventy-fourth Streets, into the East River.

There are certain general characteristics peculiar to the Fifteenth District, to which my attention has been more particularly directed, viz., drainage, "shanty population," and the ventilation of school-houses.

I deem it proper to refer to these in detail, in order to show what has been accomplished, and what is necessary to be done.

1. *Drainage.*—To this subject, the importance of which cannot be exaggerated, I have devoted much time and study. Deeply impressed with the facts developed by my observations, I made, on the 5th of April last, the following report:

Throughout the Fifteenth District, under my charge, there is a great accumulation of standing water. In many places this water has become stagnant and very offensive, in consequence of the refuse matter which is thrown into it. I have on several occasions invited your attention to the subject in reference to particular localities, where the presence of decomposing animal and vegetable matter called for prompt action, to avoid serious injury to the public health.

The remedy adopted in these cases is to cause the low places to be filled with clean earth, thus removing from atmospheric exposure the decaying and deleterious matters. At best, these are and have proven to be only temporary expedients. As the cause of the evil is widespread in its nature, and demands the application of a remedy both permanent and general in its character, I revert to the subject now, in order to bring to the notice of the Board of Health the condition of the property immediately adjoining the Central Park, and lying between Fifty-eighth and Sixty-fifth Streets—between those streets, from Fifth to Lexington Avenue, nearly half of the squares are filled with water varying from three to ten feet in depth.

By reference to the general topographical map of the Fifteenth District, which has been submitted by me, as well as to the special map accompanying this report,* it will be seen that the squares named lie in the course of one of the original drainage-streams, which, rising near the anticlinal axis of the island, flow through a devious course into the East River. Originating from perennial springs, these streams receive in their course an accumulated supply from numerous other springs; and when, as in every other case under my observation of street-construction, their course becomes obstructed, a large area becomes flooded, and the ground permanently saturated with water, and consequently forever liable to produce deleterious effects.

It requires no argument whatever to show what must be the result if this condition of things is allowed to continue, and yet the property in the locality now under consideration, is, by its position with reference to its proximity to the park, justly regarded as the most valuable for future residences. The owners of this property claim that its sanitary condition should not be neglected, and its value depreciated by this accumulation of water.

Within the last few months additional obstructions (by the filling of streets) have been made to the free flow of water along this stream, and ground which has been dry is now overflowed with water. While it is evident to the most ordinary observer that, with reference to this whole subject of deep drainage, there has been a serious neglect, the effects of which will be felt for years to come; yet, in the instance now referred to, there is a remedy which, if promptly applied, will obviate, for this section, at least, the evils which in some other cases are almost irremediable. By an examination of this particular stream and its locality,

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* See the Topographical and Drainage Map in the special report of Sanitary Engineer, in a subsequent Appendix.

I find that it is practicable to construct a deep drain to Fifty-ninth Street, at its intersection with Fourth Avenue, where the sewer is of sufficient depth to receive and carry off the accumulated water from this stream, and serve for all time as a conduit to convey its never-failing supply to the river, where it may benefit and not curse mankind by its insidious mischief. This drain should have been constructed before the streets which cross these streams were graded, since in several instances there has been a neglect to provide proper and necessary culverts, and as a consequence the intervening squares have become basins of water. By an estimate made as to the quantity of water, there are over 30,000,000 gallons now standing within the squares referred to.

I am happy to say that the action of the Metropolitan Board of Health in this matter has resulted in the construction, by the Croton Aqueduct Board, of the necessary culverts through the streets, and, when the drains across the squares are completed, will entirely remedy the evils referred to, and secure the removal of the water, and consequent permanent drainage of the soil.*

It would be well if all the other localities referred to in similar reports could receive the same attention, and permanent deep drainage be established.

The matter is one which has a direct bearing upon the future as well as the present health of the city, and deserves, as it has received, the most serious consideration. And work is progressing at Seventy-fourth, Seventy-fifth, and Seventy-sixth Streets, between Second and Fourth Avenues, which has for its aim the establishment of a system of thorough drainage for that locality. There is also a prospect of the construction of a deep drain to receive and convey the flow of an "original water-course" at First Avenue and Sixty-fourth Street to the East River, thereby reducing an obstruction which is at present proving very

* The following is an abstract of the Sanitary Superintendent's communication which accompanied these reports when he submitted them to the Board:

[" This report relates to the squares lying between Fifty-seventh and Sixty-fifth Streets, the Central Park, and Third Avenue, and to a second district in which natural water-courses are being obstructed, and malarial and unhealthful grounds created by the simple neglect to protect and continue the old water-courses in culverted channels, and permanent drains where streets are being graded and intervening lots filled in. This requirement for good sanitary drainage has been overlooked in the first-mentioned region near the Central Park, until it is perhaps too late to find any authority that can be required to reopen and protect the original water-courses. But in the last-mentioned district, viz., that lying southward from East Sixty-sixth Street and Second Avenue, it certainly is possible to preserve forever the natural drainage, and also to remove the existing sources of insalubrity in the vicinity of the Colored Home. The same remark will apply to the third region which the Inspector describes, namely, that lying between Seventy-third and Seventy-ninth Streets, Lexington Avenue, and the East River.

"The three undrained sections, which are here described by the Sanitary Inspector in the 19th Ward, comprise nearly half a square mile, and are destined soon to be populated by inhabitants of the wealthy classes, and probably from 70,000 to 100,000 in total number. The importance of the sanitary drainage of these areas cannot be overstated.

"We beg leave to mention two leading facts that will deeply concern the future inhabitants of these or other new sections which are liable to be undrained, and from the obstruction of their primitive water-courses, in the process of grading and filling, must become and forever remain '*wet ground.*' These facts are—

"*First.*—That porous grounds, which are saturated to the surface, or to within a few feet of the surface at all times, except during droughts, are favorite places for various epidemic diseases.

"*Second.*—Wet cellars are known, by observing physicians, to be generally synonymous with the terms unhealthful dwellings and sickly families. An ordinary dwelling-house with a wet cellar and with the surrounding grounds saturated with subsoil-water will inevitably be an unhealthy place. I have adverted to this subject, with evidence, in the Second and Third Annual Reports of the Bureau of Vital Statistics, of the Board. The fact that such wetness of grounds has at last been conclusively proved to be the most important of local causes of tubercular phthisis should lead to thorough and permanent deep drainage in the vicinity of dwelling-houses. The chief medical officer of England, after extensive researches throughout England, has proved that, in great towns in which deep drainage and drying of the grounds has been effected, the chief and most constant of all the good results to life and health has been that of a decrease in the amount of mortality from consumption. The investigations of Dr. H. I. Bowditch, in the towns of Massachusetts, have shown how very important this question of *deep drainage versus wet grounds* really is in the plans for sanitary improvement in the city and country. Yet this is only a single one of the many relations to health which this subject of timely *drainage and thorough dryness* of grounds, about and under our dwelling-houses, presents for sanitary and engineering treatment." E. H.

detrimental to the health of the inmates of the great public charity known as "The Colored Home," an institution eminently worthy of sanitary protection.

In this connection it is proper to allude to the condition of a large portion of unoccupied property owned by capitalists, and in some instances by the inheritors of old estates, which are partially covered with stagnant water. I can see no justice in the propriety of allowing these owners to neglect complying with the orders to fill and grade their property, while actual occupants, who are pioneers, and add to the value of these lots by their improvements, are endangering the lives of their families through this neglect. I will cite one instance:

The occupants of the populous row of buildings, known as "Nova Scotia Block," on Sixty-second Street, are and have been suffering from the effects of one of the "stagnant pools of pestilence," which is supplied from five shanties with surface privies, and the *débris* of three stables.

2. *Shanty or "Squatter Sovereignty."*—While that portion of the Fifteenth District which is contiguous to "the Park" is regarded as the most valuable and desirable property for private residences, some of it being already occupied by palatial dwellings, in which are found all the comforts and luxuries that wealth can procure, other portions of the district are covered with the rude hovels of the "rag-pickers," where squalid poverty seeks a shelter, and want and misery prevail. Vacant lots are seized upon and appropriated by this class of people, and in some instances whole squares are densely covered with these rude cabins: squares between Sixty-sixth and Sixty-ninth Streets contain seventy-four shanties and ten stables; squares east of First Avenue, between Fifty-ninth and Sixty-first Streets, contain fifty-one shanties, two hundred and eighteen persons, fourteen stables, forty-one cows; one other square sixteen shanties, four cow-stables; one other square twenty-six shanties, six cow-stables. Innumerable dogs and goats are added to this group of foul things. In the entire district there are upward of three hundred shanties. Although these cabins are temporary, and shifted with advancing improvements, yet it is a grave question whether they are not a dangerous element which should be eliminated, lest some deadly epidemic should find there a ready ally to spread contagion through the city. They certainly do require the most watchful care of the Sanitary Inspector, but, from the very nature of things, it is next to impossible to secure the observance of sanitary regulations.

3. *Ventilation of Public Buildings, especially School-houses.*—There are in the Fifteenth District four large general hospitals, six asylums, eighteen churches, eight school-buildings; four of these are public schools. The hospitals, especially "St. Luke's" and the "German Hospital," are models of this class of public institutions, exhibiting in their construction and management an enlightened knowledge of sanitary laws, and a tender care of the afflicted, worthy the highest meed of praise.

Of the four public schools, there is but one that has any thing like the necessary means of ventilation, and yet there is no place in which proper ventilation is a matter of so great a necessity as a public school. Many of the children go there from illy-ventilated and contracted rooms, only to exchange for a poisoned atmosphere one still more deleterious. How is it possible for children to learn or be taught any thing under such circumstances, with their blood poisoned by foul air, their physical energies benumbed, their mental faculties stupefied, crowded by scores into rooms in which there are no adequate means of ventilation? The sickening odors of the air, breathed over and over again by these helpless victims, are almost unendurable.

If there is any truth in the theory advanced, that tuberculosis is propagated by inhalation, what practice could be more pernicious than allowing children to be so herded as to be compelled to inhale the seeds of disease and death—a lamentable fact?

The introduction of a simple air-shaft into these buildings, with a rotating turret placed over the top, so as to create a current through the shaft under any condition of the atmosphere, would remedy this very serious evil, and such improvement should be executed without delay.

A careful survey and inspection of the tenement-houses has been made in the district, with the following results:

Whole number of tenement-houses	673
" " " families	3,605
" " " persons	14,744
Average number of families in a house	5–1
" " " persons " "	22
Largest number of families " "	18
" " " persons " "	88
Average cubic space for each occupant, living-room	586 feet.
" " " " " " sleeping-room	368 "
Greatest " " " " " living-room	1,830 "
" " " " " " sleeping-room	977 "
Least " " " " " living-room	253 "
" " " " " " sleeping-room	108 "
Total of tenement-houses with water-closets	218
" " " " " privies	455
" " " " " sewer-connection	630
" " " " without sewer-connection	43

As far as my experience extends, it is very gratifying to report that the orders of the Board have been generally cheerfully complied with, particularly with regard to the ventilation of bedrooms, and I cannot call to mind a single instance of refusal upon the part of landlords to provide the means that have been required for ventilation of sleeping-rooms. There is a marked improvement as regards the education and opinions of the masses as to the necessities of air and light as promoters of health, and it is to be hoped that the day will soon arrive when it will be impossible to find a single tenement-house in this city that has not "proper and adequate ventilation."

Throughout the Fifteenth District the tenement-houses are (with few exceptions) of modern construction, and consequently are of the better class, and were constructed with a view of conforming to the "Tenement-house Law"—a law that is doing much toward ameliorating the condition of the poor and lessening the rate of mortality, and commends itself to all.

Summary of Inspections and Reinspections.

Tenement-houses	929	Drains and sewers	151
Private dwellings	1,491	Vacant lots	267
Stables	150	Cellars	54
Yards and courts	154	Manufactories	62
Privies	116	Public buildings	23

One other subject deserves a passing notice, i. e., the filling of streets and squares with garbage and ashes. In the prosecution of the *drainage-work* and excavating in Sixty-fourth Street, which had been filled with the material referred to, the stench was stifling, and some of the workmen were made sick by the putrefying mass there found exhumed. Although this material had been deposited there and covered up some years ago, it seems impossible to set limits to the injurious effects caused by the putrefaction of garbage thus buried, and I cannot express in too strong language the culpability of this practice.

There is one feature of sanitary inspection which cannot be lost sight of, and that is the pleasure evinced among the poor and needy at the presence of a sanitary officer. They find in the visits of the Inspector a great want supplied, and they learn to look for him as for the face of a friend; and in all my duties, many times arduous and fatiguing, I have derived much satisfaction from the willing response made to every sanitary suggestion, with frequent accompaniments of warmly-expressed gratitude.

Viewed in this light alone, a thorough sanitary inspection is a great blessing to many otherwise cheerless habitations.

Respectfully submitted:

AUGUSTUS VIELE, M. D., *Sanitary Inspector.*

NEW YORK, *January* 1, 1870.

DISTRICT No. 16.

E. Harris, M. D., *Sanitary Superintendent.*

Sir: I have the honor to submit the following report of the Sixteenth Sanitary District, and of some of the work performed therein during the past nine months.

Boundary.—The Sixteenth Sanitary District comprises all that portion of the city extending from Fifty-ninth Street to Spuyten Duyvel Creek, and from Eighth Avenue to the Hudson River, which includes a part of the 12th and 22d Wards.

Topography.—The surface of this portion of the city is, with few exceptions, very uneven and hilly, large rocks entirely destitute of vegetation projecting here and there; while between them, and often at a considerable depth, winding valleys alternately descend to the Hudson or Harlem River. The highest point is reached at Fort Washington, yet several others are nearly as high—as at Tenth Avenue and One Hundred and Thirty-ninth Street, one hundred and forty-eight feet, and at One Hundred and Twenty-fourth Street, near the Hudson, one hundred and forty-seven feet—above tide-water. The lowest considerable portion is known as "Harlem Plains." This whole area is underlaid by primitive rock. The soil of the arable part is a rich loam, and is largely planted in vegetable gardens, fruit and shade trees, and, with pastures frequently intervening, gives sufficient variety to make a residence here desirable. This long strip of land is occupied, for the most part, by the wealthy and the very poor.

Along the westerly slope near the Hudson, and in other eligible sites for country-seats, the large estates of the wealthy are still unbroken, and are kept by their occupants in a good sanitary condition. However, in the southerly portion, and in the vicinity of recent improvements, frequent sales have divided these estates, and many of the city lots are now occupied by and sometimes leased to persons wishing to erect temporary dwellings.

In the early spring the Board directed an inspection of the shanty-district west of Central Park. From Sixty-third Street to Eighty-third Street six hundred and seventy-five (675) swine were found kept without permit in close, filthy pens, and fed entirely on swill. These were removed through an order of the Board, and the pens and yards cleaned, many of the owners removing them entirely, and planting gardens in their stead.

In this inspection the shanty cow-stables were found to be close and dark hovels, each containing from three to eight cows, often largely fed on warm swill from the distilleries. Some of the wagons used in the distribution of this milk to the consumers had legibly painted on them "*Pure Westchester County Milk.*" By a similar action of the Board, the owners were prevented from feeding swill, and light and air were admitted to the stables.

In June, by the efficient aid of Drs. Heath and Lordly, free vaccination was offered by the Board throughout all the Sixteenth District south of One Hundred and Twenty-fifth Street, and in the public schools at Manhattanville, Carmansville, and Inwood.

Sanitary Survey.—As regards the sanitary survey now being made by the Board, I would say some difficulty was experienced in adapting the work in this district to the blanks provided, there being so few tenement-houses. However, it was decided to enter in every case the street and avenue, name and nationality of occupants, sanitary condition of premises, number of families, total population, and the number not successfully vaccinated, and under the column of "Remarks" every low, rude, temporary dwelling was marked "shanty," and, if a private house or tenement, the number of stories high and the material of the building were recorded.

In this way every house, from Fifty-ninth Street to One Hundred and Tenth Street, west of Central Park, has been visited.

Within the above limits it is found there are 1,331 dwellings, containing 1,783 families, 8,499 persons, of whom 423 have never been vaccinated.

The dwellings are divided as follows, viz.: Shanties, 718; private houses, 561; tenement-houses, 52.

The whole number of tenement-houses in the Sixteenth District is seventy-eight, all of which have been visited.

Consolidated Statistics of Tenement-House Survey.

Total number of tenement-houses surveyed	78
" " families residing in them	423
" " persons " same	1,792
Average number of families in a house	5.42
" " persons "	22.97
Largest " families "	14.
" " persons "	54.
Total " tenement-houses with water-closets	0
" " " " privies	78
" " " " sewer-connections	4

I regret to say I have kept no records of the tenements requiring to be improved, in order to comply with the various sections of the Tenement-house Law.

The Shanties.—The shanties, of which there are about eight hundred (800) in all, are placed in German or Irish groups at every conceivable point of the compass, separated here and there by passage-ways. Their occupants are an industrious people, and many make their homes very comfortable by a skilful thatching of tin, oil-cloth, or other material, and the insides of their dwellings are generally lathed and plastered. During the drought of the past summer there was much suffering among them on account of the great scarcity of water. Their "wells" and "springs" were nearly all dry.

Free hydrants are much needed at Sixty-fourth Street and Eleventh Avenue, where fifty-four families carry all their water an average distance of more than eight hundred feet, and at Tenth Avenue and Seventy-ninth Street, and at Eighty-second Street and Ninth Avenue.

Sewers.—The work of constructing sewers has progressed rapidly during the entire season in the southerly portion of this district—a single firm, having a contract for about thirteen thousand feet, have already completed more than eight thousand feet.

The deep outlet-sewer, intended to drain the sunken lots at Eighth Avenue and Sixty-second Street, and the deep sewer to drain the pond at Seventy-sixth Street and Eighth Avenue, are being pushed forward as fast as the heavy nature of the work will allow.

Others are needed, as follows: At Seventy-ninth Street a deep outlet-sewer to drain the swamp at Eighty-sixth Street and Ninth Avenue, and terminate in the pond at Eighty-eighth Street and Eighth Avenue. Another is much needed at Stryker's Bay, or Ninety-sixth Street, to pass along the easterly side of the Boulevard to One Hundred and Twelfth Street or One Hundred and Fourteenth Street, with a deep branch to extend to Eighth Avenue and One Hundredth Street. With these receiving sewers other deep sewers and drains could be connected, and thus the whole region, now so malarial, could be redeemed.

There are several geological basins with a clay subsoil in this district, which relatively appear to be very low, but are in reality from fifty to seventy feet above tide-water.

Malarial Fevers.—With the drying up of the soil and vegetation in September last, there were many cases here of bilious remittent fever, which soon assumed a typhoid or enteric type. This was quickly followed in others with the ordinary intermittent fever, and large numbers in the vicinity of these natural basins suffered and are still afflicted. Some came within my personal observation. At Seventy-sixth Street and Eighth Avenue out of three families, consisting of nineteen (19) persons living on a single city lot bordering a stagnant pond, six (6) have died since the first of May last, four (4) of whom, it is believed, of preventable diseases.

One of the families having lost by death two members, two more, aged about nine and eleven respectively, were found at the time of my inspection entirely unconscious in the congestive stage of intermittent fever, and were soon removed to other and better quarters.

In 1865, J. Lewis Smith, M. D., in his admirable report, said: * "This point of land contains one shanty and three wooden tenant-houses, till lately but two, occupied by nine families. During the past twenty months there have been among these people dysentery, typhoid fever, intermittent fever, and cholera infantum, and three deaths of infants. These diseases and deaths were unquestionably due to the insalubrity of the place, caused by the stagnant water."

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* Report of the Council of Hygiene and Public Health, of the Citizens' Association of New York. Second edition, 1866. Page 316.

In the immediate vicinity of the swamp, at One Hundred and Eighth Street and Broadway, twenty-three families, and in the little group of houses between the Croton Aqueduct and Eighth Avenue, from about Ninety-fourth Street to One Hundredth Street, thirteen (13) families, were found thus suffering at the time of my inspection. It is needless to say many more bore the marks of malarial cachexia.

Sunken Lots.—Many sunken lots have been filled in, and a few others connected with sewers by their owners, as from time to time the Board has directed.

In one instance, at Sixty-fourth Street, between Tenth and Eleventh Avenues, thousands of loads of earth were required to fill an exceedingly-offensive pond that had existed there for years.

In this case it took ten (10) entire days to obtain the name and present address of each owner. It results here that there is, besides an abatement of the nuisance in the neighborhood, a clear advantage to the owners themselves, as each lot has increased in value more than four times the actual cost of the work.

The physical structure and great average altitude of this portion of the island, with the Central Park upon one side, and the proposed West-side Park on the other, reaching from Seventy-second Street to One Hundred and Twenty-eighth Street, and the improvements now going on in its central portion, seem to establish the fact that it will never be given up to commerce and trade, but must remain for residences and established institutions.

If such is to be its future, the importance of early deep drainage can hardly be estimated.

Respectfully submitted:

S. D. WADSWORTH, M. D.,
Assistant-Sanitary Inspector.

NEW YORK, *November* 1, 1869.

DISTRICT No. 17.

E. HARRIS, M. D., *Sanitary Superintendent.*

SIR: I respectfully beg leave to present the following report upon the general condition of the Seventeenth Sanitary Inspection District, Twelfth Ward, calling to your notice some of the improvements that have taken place and that are now in progress.

Boundary.—This district is bounded on the north, by Harlem River; on the east, by East River; on the south, by Eighty-sixth Street; on the west, by Eighth Avenue; having a long diameter, north and south, of three and one-half miles, and of nearly one and one-half miles in its greatest width, extending over an area of about five square miles.

Topography.—The greater portion of the surface of this district is but a few feet above the tide-level. The highest points are found at Mount Morris and at Ninety-second Street and Fourth Avenue. Much of the surface east of Third Avenue is below high-tide level. From One Hundred and Fourth Street to Ninety-second Street it is marshy, and the streets unopened, with the exception of Second Avenue. At One Hundred and Third Street, west of Third Avenue, a rocky ridge rises, extending southward through Yorkville, which is on the southern boundary of this district. West of Fourth Avenue the surface is generally but a few feet above the tide-level; but from Eighty-sixth Street to Ninety-sixth Street the grounds are high and rocky. The same series of rocks appears at Mount Morris Square, near the Harlem River. The soil is mostly of the alluvial deposit. The only pond of any considerable size, in this district, is situated just south of One Hundred and Tenth Street, in the Central Park. From Ninetieth to One Hundred and Ninth Streets, on the east side, are several old water-courses, none of them at present extending west of Second Avenue except one running from One Hundred and Eighth Street and East River to One Hundred and Sixth Street and Fifth Avenue, thence in a northwesterly direction to One Hundred and Twenty-second Street and Eighth Avenue. There is an old water-course running from One Hundred and Twenty-third Street and East River to One Hundred and Thirteenth Street and Second Avenue, and smaller one running directly west. Others are found at One Hundred and Thirty-fourth, One Hundred and Thirty-eighth, One Hundred and Forty-seventh, One Hundred and Forty-ninth, and One Hundred and Fiftieth Streets and Harlem River. A large portion of the surface in the immediate western vicinity of Mount Morris Square, until within a few years, was occupied by a pond.

Malarial Influences.—In connection with the topography of the district, I would respectfully call your attention to the malarial influences existing in certain portions of the ward. From One Hundred and Fourth Street and East River to One Hundred and Tenth Street and East River, extending west to Eighth Avenue, is a belt of land which is very low and is always damp from the water-courses and ponds in this section. One Hundred and Tenth Street is most especially subject to the influence of malarial poison. On the "Rocks," east of Mount Morris, malarial influences prevail, owing, as I think, to the under-stratum of rock preventing the full absorption of moisture. The site of the old pond west of Mount Morris is another place where these malarial influences are felt.

Drainage and Sewers.—Owing to the fact that many of the streets are, as yet, unopened, and that the work of sewering is constantly going on; also in consideration of the fact that it is, as yet, undecided whether it is best to fill in and sewer the low, marshy lots on the East River, or build dikes and bail them, I can give no further report than to say that the sewers are of both brick and pipe, their general direction is east, and their outlets are above low-water mark.

Several tenement-houses and private houses have been connected with the sewers during the past year by order of the Board of Health, and all new houses, on streets in which there are sewers, are sewer-connected.

Vacant Lots and Ponds.—There are in this district many vacant and sunken lots, which, during a large portion of the year, contain stagnant water. These places give rise to malarial poison, which is the occasion of much sickness. In many instances it is almost or quite impossible to find the various owners of these vacant lots. In others the Board has done great service to the public by causing them to be graded to a level sufficient to carry off all surface-water, and also to be properly connected with the sewers. In this connection I would state that most of these sunken lots, together with a great number of gutters and street mud-holes, have been thoroughly disinfected, by order of the Board, with the heavy oil-of-coal tar.

Streets.—But few of the streets are sewered, and a still smaller number are paved. Third Avenue is in process of being paved with the Belgian pavement. One Hundred and Twenty-fourth Street, Fifth to Sixth Avenue, and Ninety-second Street, between Third Avenue and East River, are also paved with the same. One Hundred and Twenty-ninth Street, from Fourth to Sixth Avenue, One Hundred and Twenty-fourth Street, from First to Third Avenue, One Hundred and Twenty-third Street, from Second to Third Avenue, and One Hundred and Twenty-second Street, from Second to Third Avenue, are paved with the concrete. Many of the streets are not yet opened; but by far the greatest cause for complaint is found in the manner in which the streets are "cleaned," or, rather, *not cleaned*. And this cause of complaint cannot cease under the present street-cleaning regulations, for the contractors say they do their duty, and, if this be so, something more is required. Under the direction of the Board of Health many of the streets have been cleaned, and the mud-holes filled with fresh earth, very much to the health and comfort of the citizens. Sixth and Seventh Avenues are being graded, and when completed will afford the finest drives on the island.

Squares.—That portion of the Seventeenth District bounded by the line of Eighty-sixth Street on the south, by One Hundred and Tenth Street on the north, by Fifth Avenue on the east, and by Eighth Avenue on the west, is included in the "Central Park" boundaries. Mount Morris Square is bounded by One Hundred and Twentieth and One Hundred and Twenty-fourth Streets, Madison and Sixth Avenues. It has been much improved during the past summer, and is now a really beautiful resort. The small square lying between Third and Fourth Avenues, One Hundred and Twentieth and One Hundred and Twenty-first Streets, has been desecrated, one corner having been sold and a row of brick buildings erected thereon.

General Sanitary Condition.—On this subject there is but little to be said. Never before within the last fifteen years has there been so healthy a season as the one through which we have just passed. Seldom has there been seen a case of typhoid fever. Scarlatina has not prevailed to any alarming extent. There have been comparatively few cases of cholera infantum, and these seldom fatal. As regards malarial influences, it may be said that they exist in certain localities, as for example over the sites of the old water-courses, and adjacent to those streets which are being excavated and graded, but they are oftener manifested by their influence on other diseases, than by well-marked attacks of intermittent fever. Much of the future welfare of the inhabitants of this portion of the island depends upon the manner in which the low and wet grounds of now unoccupied squares are disposed of, and the manner in which the sewers are constructed. Deep drainage is a positive necessity in these vacant lots that are to be filled in with fresh earth. When these improvements shall have been made, viz., sunken and wet lots filled in, and proper sewers constructed, no part of the island can excel this in its sanitary advantages. Already the work is being pushed well forward by the Board of Health. One of the worst spots in the district is that found on the east side of Third Avenue, between One Hundred and Twenty-ninth and One Hundred and Thirtieth Streets. Here is a row of wooden buildings standing over the water where the tide ebbs and flows, but with insufficient force to remove refuse materials that accumulate here. These lots should be filled in, and a proper bulkhead constructed at the corner of One Hundred and Thirtieth Street and Third Avenue, preventing the further flow of the tide. Orders have been served by the Board on the owners of this property to fill in these lots with fresh earth, and no doubt these orders will soon be complied with.

But it is not by such improvements alone that the Board's beneficial influence is being exerted in Harlem, as well as in other parts of the metropolis, for the principles and plans of sanitary care, and the safeguards of sanitary government, which it has brought into active exercise, are continually aiding and instructing the people in these things.

Vaccination.—By direction of the Board, a thorough canvass was made of the schools and of the tenement-house and shanty population throughout the Harlem district, for the purpose of offering free vaccination. In all cases your Inspector was kindly received, and in but few families were there any objections raised which were not easily overcome. The vaccinations were in a high degree successful. In no instance was I called to see a case of erysipelas or any accident resulting from vaccination. Thus, owing to the prompt action of the Board, this district received timely protection against small-pox.

In the tabulated statement will be found the number of vaccinations made.

Areas, Alleys, and Yards.—During the past year there has been great improvement as regards the cleanliness of alleys, areas, and yards, and this is in a great measure due to the systematic inspection which has been pursued; nearly all are now graded so as to allow the surface-water to flow away through proper drains provided for it.

Domiciles.—These may be divided into, first, private residences, brick or brown-stone front and wood; second, tenement-houses, brick and wood; third, shanties, or temporary wooden domiciles of one story. The first are, with few exceptions, well built and large and comfortable, and each year adds to the number of spacious dwellings, furnished with all "modern improvements." Many of these houses are occupied by two and three families, but in nearly all such cases they do not present at all the appearance of the old-style of tenement-houses. In the tenement-houses the improvement, in a sanitary view, has been most marked. Under a systematic inspection by direction of the Board, they have been made to meet the requirements of the "Tenement-house Act," in nearly every building. Of the 155 tenement-houses in this district, there are at present scarcely thirty that are not furnished with proper means of ventilation and with fire-escapes. In regard to the sections of the law that have been found violated, an account is given below. In general, these houses are well built and well kept. The sections of the law found violated are as follows:

SEC. II. Violated in seventeen instances. In but two houses have there been found sleeping-rooms which had no ventilation whatever. In the other fifteen there were windows communicating with the dwelling-rooms, but not with the hall. In every instance but three, where reinspections have been made, the order of the Board has been found complied with.

SEC. III. Violated in twenty-four instances. These have been complained of, and, under the direction of the Superintendent of Buildings, proper fire-escapes have been or will be soon provided.

Sec. IV. In no case has this section been found violated.

Sec. V. In two instances this section has been found violated where it could be remedied. In other cases there have not been the needed connections with sewers; but the sewers were not constructed, and, of course, the connections could not be made. Where unavoidable, cesspools have been made, and are kept tolerably clean.

Sec. VI. There are no cellars occupied as dwellings, and but few basements so occupied in this district; and in no case have the requirements of the law been found violated.

Sec. VII. This section has not been found to be violated.

Sec. VIII. In the clause respecting garbage-boxes, this section has been found violated six times. But, in many instances where there are boxes or barrels provided, the tenants will persist in throwing garbage into the streets and gutters. In other cases, where garbage is placed in proper receptacles, the non-performance of duty on the part of the contractor in collecting the garbage leads the tenants to disregard the boxes, and thus the gutters and streets soon become filthy. There seems to be quite as much room for improvement on the part of tenants, in regard to this section, as to any other contained in the "act."

Sec. IX. In but four instances has this section been found unviolated, in regard to the clause respecting the posting of the owner's name and address in the hall. It seems difficult to find any good reason why this section is so often violated. The main reason given is that it subjects the owner to unnecessary trouble, from the tenants running to him with petty complaints. But this clause should be enforced, as without it the Inspector is often led astray, and much valuable time lost.

Sec. X. In all cases easy access has been had to the tenement-houses by the Inspector. There has been no occasion for complaint in regard to other clauses of this section.

Secs. XI., XII. In regard to these sections there has been found no occasion for complaint.

Sec. XIII. There have been found no violations of this section. There are but few houses on the rear of lots in this district.

Sec. XIV. This section has not been found violated in any instance. In but few tenement-houses are the bedrooms provided with flue ventilation instead of transom or ventilating windows opening into the hall.

Secs. XV., XVI., XVII., XVIII., XIX. The remaining sections of the act have not been found to be violated.

Privies.—In nearly all cases tenement-houses are provided with privies connected with the sewers, wherever there is a sewer in the adjacent street. In a few houses there are water-closets in the halls or cellars. There is a want of sufficient flushing in many cases, to carry the night-soil into the sewer. In other cases the connecting-pipe becomes obstructed, and the privy-vault rapidly fills up and becomes a nuisance. In other instances the drain-pipes are not placed so as to conduct the excremental outflow from the dwelling into the sewer. There is great need of more thorough inspection and reinspection of privies and privy-vaults than your Inspector has been able to give during the present season.

Swine.—In one instance swine have been discovered, and the owner notified that the keeping of them was in violation of the law. They were immediately sold, and thus the cause of complaint removed.

Cow-Stables.—These are usually situated in the sparsely-settled portions of the district, and are well kept, being provided with properly-constructed manure-vaults and drains from the stables. The cows are well fed and are healthy-looking.

Fat-Boiling.—There are no fat-boiling establishments in this district.

Fertilizer Manufactory.—There is an establishment of this kind situated at the foot of East One Hundred and Sixth Street. The fertilizer is manufactured from blood-refuse, pulverized bones, sulphuric acid, and earthy materials. Sulphuric acid is, of course, used to develop ammonia and its compounds. The odors arising from this place and filling the air give rise to great complaint on the part of the citizens living near. This fact has been reported by your Inspector, and the Board of Health now has the nuisance under strict orders.

Markets.—There are no large wholesale markets in this district. The smaller markets, for the sale of meat, fish, vegetables, etc., are generally well kept—increased patronage being a result of cleanliness.

Slaughter-Houses.—There is a slaughter-house situated on the southwest corner of One Hundred and Fourth Street and Third Avenue, which is kept in as good condition as such a place can be kept. But, in consideration of the rapidly-increasing population of that portion of the district, your Inspector would recommend its removal for your consideration.

Streets—How Occupied.—By far the greater number of stores and tenement-houses are located on Third Avenue. These buildings are mostly of brick, from three to five stories high. Upon the cross-streets are situated most of the private houses.

Nearly all of the "shanties" are situated west of Fourth Avenue, and are built either upon the rocks, or in low, marshy places, without regard to any order. Of course, cleanliness or comfort is not in any great degree consulted. The nationality of the occupants of these shanties is, without exception, Irish. But, with all their want of sufficient room and cleanliness, they are quite as healthy, with the ventilation they *must* have, as those of their fellow-countrymen who live in tenement-houses.

Sanitary Survey.—Your inspector has, under direction of the Board, made a complete sanitary survey of this district. The survey was intended, more especially, for the thorough and systematic inspection of the tenement-houses in the district. This work included the thorough inspection of three hundred and sixty squares. In a tabulated form, given below, will be found the statistics of the inspections and reinspections made by your Inspector during *the present season:*

Tabulated Statement of Inspections and Reinspections.

INSPECTIONS.		REINSPECTIONS:	
Tenement-houses	50	Tenement-houses	43
Gutters	49	Gutters	13
Privies	32	Privies	6
Stagnant water	37	Stagnant water	37
Garbage and boxes	17	Garbage and boxes	4
Cesspools	5	Cesspools	1
Sunken lots	51	Sunken lots	51
Cellars	2	Cellar	0
Manure	3	Manure	3
Stables	10	Stables	3
Streets	35	Streets	35
Fertilizer manufactory	1	Fertilizer manufactory	1
Gas-pipe	1	Gas-pipe	0
Fish-market	1	Fish-market	0
Brewery	1	Brewery	1
Ditches	5	Ditches	5
Sewers	10	Sewers	8
Total inspections	310	Total reinspections	211

Total inspections and reinspections.................... 525

Tabulated Statement of Tenement-house Survey.

Number of tenement-houses	155
" private houses	2,740
" shanties	522
" other buildings	813
" families occupying tenement-houses	713
Population of tenement-houses	2,763
Number of privies	400
Average cubic feet for occupant (living-room)	600
" " " " " (sleeping-room)	300

Sections of Tenement-house Law violated.

Section II.	17	Section VIII.	6
" III.	24	" IX.	150
" V.	2		

Statement of Vaccinations.

Number of tenement-houses visited, 150; number of private houses and shanties visited, 400; number of persons vaccinated, 175.

In conclusion, I would state that the work of the Board is appreciated. In almost every case its suggestions and orders have been faithfully and promptly complied with. A great work has been accomplished, and much similar work will have to be perpetually repeated in a vast city like New York.

Respectfully submitted:
IRA B. READ, M. D.,
Assistant-Sanitary Inspector.

NEW YORK, *January* 1, 1870.

DISTRICT No. 18.

E. HARRIS, M. D., *Sanitary Superintendent.*

SIR: The following report upon the sanitary condition of the Eighteenth Inspection District is respectfully presented.

The Eighteenth District comprises the whole of the Tenth, and a part of the Seventh Wards. It is bounded on the north, by Catharine and Division Streets; east, by the East River; south, by Rivington and Jefferson Streets; west by the Bowery; and contains a population of 52,000, mostly Germans. The topography of the district formerly consisted of low sand-hills, interspersed with meadows and marshy grounds. Along the eastern boundary the island has encroached upon the river, and what is now South, Water, and a part of Cherry Streets, was once swamp and low land. Now these sand-hills have been removed, the wet grounds on the river-front reclaimed, and the swamps and marshes drained, giving to the district a level and uniform appearance. The highest point above the tide-water is at the junction of Canal Street and the Bowery, and gives a grade from the East River to the point mentioned of forty-five feet. The district, with its natural facilities for drainage, and its sandy soil, is eminently favorable to an excellent sanitary condition and general health.

That portion of the district comprising the Tenth Ward is inhabited by a large German population of the middle class, which nationality embraces almost the entire population of the Ward, and contrasts strongly with the lower part of the Seventh Ward with its Irish population. In cleanliness, and attention to ventilation and other sanitary conditions, though far from perfect, the Germans excel their neighbors. This is seen, and its action in relation to the general health has been conclusively shown by comparing the occupants of tenement-houses, both German and Irish. Perhaps the social relations of the Germans, so different in all their elements from the Irish, and their distinctive national peculiarities more than any thing else, account for the preponderance of Irish over German mortality.

Tenement-Houses.—The tenement-houses of this district are mostly of brick, and built solely to meet the exigencies of the large increase of a class of people who demand comfortable habitations at a small expense. There are a few old private dwellings which have been remodelled into tenement-houses. These are in most cases every way unfit for the dense habitation for which they are designed, and are a prolific source of mortality and disease. These buildings, however, constructed for the express purpose for which they are used, are with a few exceptions safe and commodious habitations. Their chief defect is inadequate roof-ventilation, and I have often noticed, when the Board's order in relation to roof-ventilation has been complied with, the marked change in the purity of the air at a subsequent inspection. It has been found easier and more practicable, from the nature of the construction, where ventilation was imperfect in the roof, to insert latticed windows in the bulkhead. This has, in every case where such a ventilator has been used, proved sufficient. In some rear houses a ventilating flue has been inserted in the scuttle door, which, in the absence of a bulkhead door, has given the required ventilation. In the Tenth Ward are found what may be designated "model tenement-houses." These models comply in every respect with the law, and offer superior accommodation in all sanitary respects. I would particularly mention three, viz., 63 Orchard Street, 89 Delancey, and 137 Eldridge Street. In these houses complete and thorough ventilation is secured in every room; each hall and suite of rooms is provided with sinks, water and waste pipes; a separate water-closet for each family, and a suitable garbage-box. The stairs are capped with corrugated iron plates, the halls covered with oil-cloth, and each floor freely communicates with the external air. The cellars are provided with gas, as well as each room. The basement of 63 Orchard Street is used for night-lodgers, and offers at a low rate sleeping-accommodations for from thirty to thirty-five persons. This basement is well ventilated, and is a notable exception to that class of habitations in other quarters of the city. The most noticeable improvements in the tenement-houses of this district are, the removal of the old dilapidated wooden structures, and the erection of large, roomy, and commodious brick buildings, in compliance with the sanitary suggestions of the Board of Health, the erection of fire-escapes, and the adoption of more complete methods of ventilation. Throughout the whole district the Board's influence and orders have been signally felt, as is shown by the ready compliance of owners and agents with its suggestions. Many instances could be cited where improvements in regard to ventilation have been made, without any order from the Board, upon simply the recommendation of the Inspector. In fact, owners seem fully aware of the benefit accruing from a system of perfect ventilation, and hasten to avail themselves of its advantages. The majority of the tenement-buildings erected during the present year have complied with § 2 of the law, and are in every point safe for human habitation. Much remains, it is true, to be done —not alone with landlords, but with the tenants themselves—but the reform has commenced, and the results thus far are most flattering and satisfactory.

Halls, Areas, Alleys, and Yards.—One of the great evils of tenement-houses, and where reform is most needed, is the neglect of whitewashing the halls and rooms; but some improvement is manifested in this direction, more, however, among the tenants, than the owners. The improvements in yards, areas, and alleys, are most apparent—sunken pavements reset, obstructed cesspools cleared, and the providing of garbage-boxes, are a few of the many sanitary changes. Yards and alleys, save in a few isolated cases, are kept free from filth and rubbish. Garbage is now in the majority of cases disposed of in the regular way, and is not allowed to accumulate and obstruct the street-gutters. These changes are most marked in Chrystie, Forsyth, Delancey, Ludlow, and Essex Streets. Hamilton, Madison, and Cherry Streets, between Catharine and Market, are still in a condition, at times, detrimental to the public health. Here, however, as elsewhere, the reform is making progress.

Basements and Cellars.—There are comparatively few basements used for habitations in the Tenth Ward. Those so occupied are well provided with light and ventilation. In the Seventh Ward the case is different. In Cherry, Water, and Hamilton Streets, many cellars have been used which were entirely unfit for habitation. Most of these have either been vacated, or are under the orders of the Board of Health for vacating. The basements of the Tenth Ward are mostly used as stores and lager-bier saloons, and comply in their construction with the provisions of the Tenement-house Law.

Hydrants, Gutters, and Leaders.—Many of the older tenement-houses are defective from imperfect leaders, which permit the water to escape, to the detriment of the walls and foundations, and this is a source of disease. Many of the hydrants have no sewer-connection, the surplus water overflowing the sidewalk into the street, creating offensive odors, and rendering the sidewalks almost impassable.

Piers.—The condition of the piers is unchanged. Some of them, from imperfect construction, retain quantities of filth and offal, which often remain for days.

The number of blocks completed in the tenement-house survey is seventy-four, and comprises the following:

Tenement-houses	818
Tenement-house families	8,528
Tenement-house population	30,115
Average number of families to each tenement-house	9.90

Average number of persons to each tenement-house	39.01
Largest number of families in a tenement-house	28
Largest number of persons in a tenement-house	168
Manufactories	21

Respectfully submitted:

HENRY O. ELY, M. D., *Sanitary Inspector.*

NEW YORK, *January* 1, 1870.

DISTRICT No. 19.

E. HARRIS, M. D., *Sanitary Superintendent.*

SIR: I have the honor to present the following report upon the sanitary condition and inspectorial work in the Nineteenth District, during my supervision of it as sanitary inspector. This district is bounded: on the north, by East Fiftieth Street; on the east, by the East River; on the south, by East Thirty-eighth Street; and on the west, by Sixth Avenue. It contains 1,844 private houses, 479 tenement-houses, 352 shanties, and 369 other buildings of various kinds. It has a total population of 26,436 souls—of which 8,383 dwell in private houses, 16,419 in tenement-houses, and 1,634 in shanties.

Streets and Gutters.—The general sanitary condition of the district is very good, the majority of the population being of a class which takes an interest in keeping its surroundings clean. In some of the streets slops are thrown into the gutters (by occupants of tenement-houses); and, from the fact of the grades being insufficient, the water stands in pools along the road-side. These streets have been repeatedly cleansed and disinfected during the past summer, under the direction of the Board of Health, but it is impossible to keep them clean for any length of time. I think they should be thoroughly washed out once or twice a day, by flushing them with water from the Croton hydrants. Tenants cannot be restrained from throwing their slops into the street-gutters, in front of their dwellings.

Areas and Yards.—There has been great improvement in many of these. During the inspection many were found which, from improper and faulty flagging, and neglect on the part of tenants in keeping the drain-pipe clear, were always wet with slops or rain-water. Many yards were so drained that rain, or other water, found its way into the basements and cellars; and, consequently, in many inhabited cellars there was almost constantly a pool of water under the floor. Attention to the drainage has remedied this evil. Where there is a house-keeper living in the house, I have noticed that these difficulties in the drainage of the yards seldom exist.

Garbage and Garbage-Boxes.—Most of the tenement-houses in this district are without proper garbage-boxes, the tenants keeping their garbage and rubbish in small pans or pails; and, when these are full, depositing them on the sidewalk, and leaving them there exposed to mischievous boys and stray goats. These pans, heaped full, are often overturned, or at least much of their contents is allowed to be spilled, thus keeping the gutter and street in such places in a filthy condition. Good, large garbage-boxes are much needed; and, in my opinion, the large wooden box, with close-fitting covers, answers the purpose as well as any other garbage-receptacle, and is the most practicable.

In some sections, where the "shanties" predominate, no attempt is made to collect the garbage and rubbish; and the people, having some desire to appear clean, get rid of it by throwing it over the high cliffs, which generally surround their habitations, thus rendering the neighboring sidewalks any thing but pleasant thoroughfares.

Cellars and Basements.—There are but few cellars or basements occupied as dwelling-places in this district. None have been found that could not easily be made comfortable habitations. The necessity of owners having a permit for leasing these cellars has proved serviceable as a means of obtaining desired improvements. Most of the cellars and basements are now in good sanitary condition. Some, not occupied as dwellings, have been found, which, in rainy weather, are very wet, the water gaining access through crevices in the ledges on which the houses are built. Where such houses are situated on a street having no sewer, it is difficult to remedy the evil, except by filling in the cellars with fresh earth or gravel—and this expedient has been adopted.

Sewers.—The work of putting in sewers is, in many places, slow and difficult, on account of the rocky nature of the ground—it being necessary to blast the sewer-bed through solid rock for long distances. Some of the sewers have been laid above the level of the original water-courses, and afford no land-drainage. Care should be taken that this fault is not committed in future. Sewers, coming from the streets whereon slaughter-houses are situated, discharge the bloody sewer-matter into the river at its margin, and here it remains, there not being sufficient current to carry it away. Every passing steamer stirs up this filth, and throws large quantities on the shore, to emit its foul-smelling and poisonous gases into the surrounding air. All this might be prevented by leading the sewer out into the river, so that the discharge might be into the swift current.

Fat, Bone, and Offal Boiling.—The business of fat-boiling and tallow-rendering is carried on at two establishments in this district. Machinery has been adopted, the object of which is to condense and convey into the street-sewer all the noxious vapors arising from the process of boiling. Still some odor will escape, and these places must always be a source of complaint, until they are driven from the built-up portions of the island. The business of offal and bone boiling was carried on surreptitiously at one place, for a short time, during the summer; the factory was worked every morning between the hours of 2 and 4½ o'clock. It was vacated before opportunity was afforded of punishing the offender.

Slaughter-Houses.—The business of slaughtering is carried on quite extensively in some portions of the district; but it is conducted in as cleanly a manner as possible. There are one or two of these establishments situated in the very midst of squares crowded with private and tenement-houses. Many and bitter complaints have been made to me against these. The disagreeable, sickening smell, from the slaughtered animals, and the continual bellowing of cattle, bleating of sheep, and shouting of men, render the places any thing but desirable in populated neighborhoods. They are even the cause of pecuniary loss to the owners of surrounding houses, for the most patient and indifferent tenant cannot long endure such a continued uproar.

Markets.—There is one large public market in this district. It is new and well appointed throughout.

Vacant Lots.—There are large numbers of vacant lots in the district, but with one or two exceptions these are naturally dry, and in good sanitary condition. In some places, parties intending to build houses have excavated the cellars, and then abandoned their undertaking. These excavations, having no drainage, became ponds of stagnant, foul-smelling water, and have been filled with fresh earth by order of the Board of Health.

Manure-Vaults and Manure.—During the sanitary survey, many stables have been found unprovided with any manure-vault or box, the manure being thrown on a heap in the open air, and this often in close proximity to crowded tenement-houses. Where practicable, the owners, under the direction of the Board, have constructed water-tight vaults to receive the manure and stable-drainage. Where the construction of vaults was impracticable, from the rocky nature of the ground, or other causes, large boxes, with tight-fitting covers, have been constructed. The condition of the horse and cow stables has in this way been greatly improved. Manure has been collected in large quantities, for shipping, at the foot of East Thirty-eighth Street. This manure is forked over and left exposed in the open air, giving off its offensive odors.

Privy-Vaults.—Most of the privies are provided with spacious vaults, connected with the street-sewer by a six-inch stoneware pipe. These vaults are flushed by water from the roof, or sometimes from the yard-hydrant. This is the best arrangement that can be made, next to water-closets. The vaults become filled during the warm, dry weather, and of course offensive; again, during a rainy period, there is apt to be some odor from the vault. I have received complaints against privy-vaults, constructed in perfect accordance with the law. Where practicable, I think water-closets, flushed by Croton water, should be adopted, and the whole system of privy-vaults done away with.

Tenement-Houses.—The tenement-houses in this district have each been subjected to the most thorough examination, on all the points relating to their sanitary condition.

Of the four hundred and seventy-nine tenement-houses in the district, two hundred and seventy have been found to be in compliance with the law in every respect. The great majority of the two hundred and nine houses against which complaints have been made were built without much regard to proper ventilation, being in other respects, many of them, model houses. Owners are generally ready to make any improvements, in the ventilation of their houses, that may be recommended. The most common point of non-compliance with the law is the name of the owner or agent not being posted, and this requirement owners seem rather unwilling to comply with. Roof-ventilation in the halls has been much neglected, and, even where ventilators had been made, they were too small to be of much use. Much improvement has been made in this respect. In most of the tenement-houses, the halls are very dark, and consequently damp, dirty, and unhealthy. Plenty of light in a hall is essential not only to its healthfulness, but cleanliness. Where hall bedrooms (or other rooms across the ends of a hall) exist, light and ventilation are easily obtained by cutting a window from these rooms into the hall. This has been done in many cases.*

Respectfully submitted :

W. L. HALL, M. D.,

NEW YORK, *November* 1, 1869. *Assistant-Sanitary Inspector.*

DISTRICT No. 20.

E. HARRIS, M. D., *Sanitary Superintendent.*

SIR: The Assistant Inspector of the Twentieth Sanitary District respectfully submits the following report of a period of labor beginning September 1, 1869.

Boundaries.—The Twentieth Sanitary District comprises that portion of the 11th Ward which is bounded on the north by Fourteenth Street, on the east by the East River, on the south by Sixth Street, and on the west by Avenue B.

Occupation of Lots.—The lots bordering on the East River are mainly occupied by founderies, machine-shops, and ship-yards. On Avenue B, between Tenth and Sixth Streets, and on Seventh Street, between Avenues B and C, are a few private dwellings. The rest of the district is almost exclusively occupied by tenement-houses.

Commerce.—No portion of the district is extensively devoted to commerce. Such commercial business as is transacted is not confined to any particular locality, but is carried on generally in the basement-fronts of tenement-houses by petty retailers, whose trade is measured by the daily wants of their neighbors.

Nationality of Population.—The population are almost without exception Germans. Being thus massed together, without much association with people of other nationalities, they preserve many habits and customs, especially with regard to kinds of food, cooking, and sleeping, which they brought from their fatherland.

At least one-half of the population live by trades practised in the rooms where they dwell, the three predominant trades thus carried on being cigar-making, shoemaking, and tailoring.

The few Irish in this district live mainly on Fourteenth Street, and on Sixth, Seventh, and Eighth Streets.

Topography.—The highest point of land is at the corner of Sixth Street and Avenue B, being about 12 feet above tide-water mark. The corner of Avenue B and Fourteenth Street is above tide-level about 9 feet, so that the average level of the western and highest line of this district is only about 10½ feet above tide-water. Nearly the entire district was originally marshy soil, drained by streams flowing in a southeasterly direction to the East River. As the ground which now occupies the place of the original marsh is loose in consistency, and readily saturated with water, and as the average altitude of the surface above tide-water is not more than 5½ feet, the impracticability of keeping cellars dry enough for human habitation is evident. East of Avenue C, and south of Ninth Street, there are no cellars which are at any time free from dampness.

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* Dr. Hall having resigned on the 1st of November, his inspection district was combined with the Thirteenth District. The statistics of the tenement-house survey in the Nineteenth have been combined with those of the Thirteenth, and are given in the report of the latter.

The sewers have their outfalls into the East River, at the terminations of Sixth, Seventh, Eighth, and Fourteenth Streets; following, as nearly as is consistent with the directions of the streets, the course of the natural drainage.

Of the thirty squares in this district, nineteen are rectangular in form, and eleven are irregular. The only street wholly in the district is Dry Dock Street, which extends from Tenth to Thirteenth Streets, between Avenues C and D.

Estimated Population.—The population of the Twentieth Sanitary District, according to the estimate made during the sanitary survey, is 21,996.

This estimate was carefuly made, and is believed by the Inspector to be as correct an enumeration as can be made of such a class of population, by going from house to house, and deriving information from heads of families.

The following is a tabulated statement of the number of inspections and reinspections made in the Twentieth District:

Inspections and Reinspections.

Tenement-houses	802
Private houses	243
Stables	65
Stores and factories	71
Public schools	2
Rag-storing rooms	5
Tanneries	1
Ship-yards	2

Statistics of the Tenement-house Survey.

Tenement-houses	752
Number of families	5,264
Number of persons	21,173
Average number of families in a house	7
" " persons " "	28+
Largest number of families in a house	19
" " persons " "	73
Number of tenement-houses with water-closets	13
" " " " privies	739
" houses sewer-connected	694

Ventilation.—The law relating to proper ventilation is found to be the one most frequently violated. Very few among the 700 tenement-houses inspected in the course of the sanitary survey complied in full with the requirements of Section No. 2.

The necessity of a free circulation of air, in rooms inhabited by from four to eight persons together, needs no argument. The average cubic space per occupant in the tenement-houses of the Twentieth District is, according to a careful estimate—in sleeping-rooms, 205+ cubic feet; in dwelling-rooms, 300+ cubic feet. And in such restricted space thousands of men, women, and children, not only live, but earn by physical labor the means by which they live. That such persons should, in addition to other causes of ill-health, suffer for want of so cheap a thing as air, is a disgrace to civilization. The Inspector is able to state, from personal observation, that great improvements have taken place in this regard since the sanitary ordinance began to be enforced. Proprietors, although generally reluctant to make the required alterations, have frequently done so at the suggestion of the Inspector, without compelling him to make formal complaint.

As a rule, those apartments in which the tenement-house population spend most of their time during the day are furnished with two windows, by means of which a fair current of air can be set in motion through the room. In many cases a transom-window over the door makes the means of ventilation comparatively perfect. The construction of sleeping-rooms gives more cause for complaint.

Many have been found—and some still exist—entirely destitute of any ventilating aperture whatever. The method of connecting them with the halls by cutting windows through the intervening walls has generally proved both practicable and efficient. In a very few tenement-houses the sleeping-rooms are ventilated by means of metallic flues, extending perpendicularly from the rooms, through the roofs, to the open air. The most difficult sleeping-rooms to ventilate are inner rooms, which can communicate neither with the halls nor with the open air. Tenants naturally object to sleeping in rooms which have any sort of opening into the apartments of their neighbors. There seems to be no better method of ventilating such closets than the use of the metallic pipes passing through the roof. The ventilation of halls is, at the present time, quite well attained throughout the district, by means of bulkheads, furnished with a movable door or window. These bulkheads, in many houses, are connected with the floor below by a ladder—or by steps—thus serving well as fire-escapes.

Fire-Escapes.—There are still too many houses in various parts of the district unsupplied with any adequate means of escape from fire.

Staircases.—But few cases have been found of dangerously-broken floors, stairs, or banisters; such nuisances being generally attended to by the tenants themselves. The same statement applies to leaky roofs.

Privies and Water-Closets.—Of the 752 tenement-houses in this district, only thirteen are furnished with water-closets. These are in the first-class tenement-houses, and are used by people more intelligent and more cleanly in their habits than the average population. Still the inevitable temptation to throw small kitchen-refuse (such as potato-parings, sour bread, bones, or cabbage-leaves) into the water-closet pipe, to save the labor of carrying it down stairs, is occasionally yielded to. Of course, it results in the obstruction of the pipe; and then, until the always tardy agent has attended to the evil, the water-closet remains a horrible nuisance. On account of the pipes being so easily obstructed, and the great difficulty of clearing them out, and the intolerable nuisance they become in a house when obstructed, water-closets for use among a negligent, unclean, and crowded population are inferior to outdoor privy-vaults. The privy-vault is easily repaired, cleaned, or disinfected.

In the Twentieth District there is an average of one privy to three families. Nearly all of them connect with the sewer, and are flushed by rain-water and drainage from the hydrant. Their usually offensive character is due chiefly to the filthiness and carelessness of the people; though it is noticeable that, as a general rule, where proprietors have erected decent, well-built houses over the vaults, tenants are more careful in the use of them than where, as is usually the case, the vaults are surmounted by roughly-built, dilapidated shanties.

Cellars.—The cellars and basements of this district generally are damp. East of Avenue C they are so wet as to be unfit even for storage-room. On Avenues B and C they are occupied by various tradesmen, bakers, fat-renderers, etc. With a few exceptions on Seventh and Sixth Streets, they are not used as human habitations.

Whitewashing and Painting.—As regards whitewashing and repainting, the improvement which the Board of Health has effected in tenement-houses is very marked. Instances are known to the Inspector where, after walls had been newly whitewashed, and woodwork freshly painted, throughout a crowded tenement-house, at the expense of the landlord, the tenants themselves have voluntarily scrubbed long-neglected floors, staircases, and windows.

Stables.—Stables are, under all circumstances, in some degree, a nuisance in the midst of a closely-crowded population. This nuisance has been greatly mitigated by the efforts of the Board of Health. There are five stables in this district, containing more than ten horses each. The largest is that of a street railroad company on Eleventh Street, between Avenues C and D. This establishment, being thoroughly drained and carefully cleaned every day, is much less a nuisance than many which accommodate only one horse. As a rule, the larger stables are now in as good sanitary condition as is practicable for a stable to attain. The small stables, generally situated at the rear of the tenement-house yards, with an exit through the house itself, are among the greatest nuisances which the Inspector meets with. These have in all instances been carefully inspected; and, wherever carelessness in cleaning, or deficiency of drainage, gave cause for complaint, complaint has been made, and an improvement effected.

Streets and Gutters.—The streets throughout the district are paved with cobble-stone, or Belgian pavement. They are at all times in a filthy condition. The uneven surface of the pavement renders it impossible to remove, by ordinary means, all the mud and filth which accumulates. Frequent sunken places, or depressions in the pavement, contain rain-water long after the surrounding surface is dry. The gutters are so badly graded that in many streets they are never free from puddles of stagnant foul water. When, as is often the case, the streets are not cleaned for many days, the mixture of mud, filth, and water becomes offensive to the nostrils of every passer-by. It is unnecessary to state that such a decomposing mass must be a prolific source of disease.

Garbage.—The inhabitants of tenement-houses are, in a great measure, responsible for the insalubrious condition of the streets. One of the longest steps toward sanitary reform will be taken when tenants are compelled to take proper care of their "garbage." Some improvement is perceptible, but the efforts which the Inspector has made in this direction have not resulted satisfactorily. Every family is supplied with a garbage-vessel of some kind; usually either a tin pail or a large pan. But not one house in five has a general receptacle for the contents of these small vessels. Every house has had one at some time, but it was a barrel or a wooden box, and of course was stolen for firewood. The consequence is that the pail or pan is emptied either into the gutter or the privy-vault, where in either case it becomes a nuisance.

As a remedy for this evil, the Inspector would respectfully suggest that tenement-house owners be compelled to furnish, for every house, a metallic vessel holding as much as an ordinary barrel, to be always kept either in the yard, or upon the edge of the sidewalk. It would take up little room, and would surely be less unsightly than heaps of uncovered garbage. It should be furnished with handles for convenience of dumping into the garbage-carts, and should have painted upon it the number of the house to which it belongs. And it should be the duty of police-officers to take prompt notice of any violation of the law relating to them.

Filthy Habits of the People.—The population of this district suffer more from the evil of personal uncleanliness than from any other one cause of insalubrity. Of course, there are many exceptions to this rule, even among the poorest of the inhabitants of tenement-houses. It is noticeable that they vary in this regard, according to the different localities from which they emigrated. By far the filthiest class are those who came from Bohemia. They are scattered through different streets of the district, generally in groups of several families in a house.

The Inspector has not failed to try to induce such tenants to improve the condition of their dwellings, by personal attention to cleanliness, but long habit and blunt perceptions of the evils of filthiness render them almost hopeless in this respect. This greatest cause of insalubrity, for which they are themselves responsible, can best be affected by removing those causes over which they have no control. Moral suasion has no effect on these people so long as they are compelled to live in dirty, ill-ventilated houses, and on filthy or carelessly-cleaned streets. The effect upon the personal habits of the population, of a rigorous enforcement of the sanitary ordinances, has been, under the observation of the Inspector, one of the most beneficial results of the work of the Board of Health.

No difficulty has ever been experienced by the Inspector in gaining access to houses or families for the purpose of inspection. The intention of the Inspector's visit is universally regarded as benevolent, and every means of information is almost always readily afforded him.

Respectfully submitted:

W. T. CARPENTER, M. D.,

Assistant-Sanitary Inspector.

NEW YORK, *January* 1, 1870.

Report by the Water-side Sanitary Inspector.

To E. Harris, M. D., *Sanitary Superintendent.*

Sir: I have the honor to report as follows on the "water-side" sanitary inspection which I have prosecuted under your direction since the beginning of the last spring.

In pursuing this work, the main objects kept in view have been the observation and recording of the important features in the sanitary condition of those portions of the city bordering on the water, and in the sanitary management of certain classes of ships, with the conviction that the inquiry cannot but lead to measures for diminishing the vital risks to which an important class of the population is unnecessarily exposed, and increasing the security of the city against the advances of epidemic disease.

Emigrant Vessels.—A great portion of my duties has been performed on board of emigrant vessels, in an inspection of their sanitary condition prior to the issuing of the Board's permit, as required by Section 166 of the Sanitary Ordinances,[*] and Section 25 of the Rules and Regulations.[†]

The following form has been adopted to facilitate observation and record:

1. Class, name, tonnage; flag;
2. Position when inspected;
3. Captain;
4. Surgeons;
5. Consignees;
6. Nature of cargo;
7. Port of departure;
8. Date of arrival;
9. Number of days at sea;
10. " " officers and men;
11. Health of officers and men;
12. Number of cabin and steerage-passengers;
13. Predominant nationalities;
14. Deaths on the voyage; ages; causes;
15. Detention at quarantine; cause;
16. Sanitary orders complied with at quarantine;
17. Number of steerage-stewards;
18. Sanitary condition of passenger-decks;
19. Quantity and condition of refuse steerage bedding;
20. Sanitary condition of hospital;
21. " " " forecastle;
22. Number and condition of water-closets. How flushed?
23. Sanitary condition of hold;
24. " " " passengers;
25. Cases of small-pox or other infectious or contagious disease;
26. Nature of permit issued and orders given;
27. Hour of issuing permit;
28. Number of permit;
29. Hour of landing steerage-passengers.

I have thus inspected and put on record in your office 33 emigrant sailing-vessels, bringing 4,486 passengers, and 100 emigrant-steamers, bringing 72,395 passengers, making a total of 133 vessels and 80,881 passengers. Of these vessels, 102 were inspected in the stream. The remainder were inspected soon after they reached their respective piers.

These duties have been recognized with courtesy by the officers of the vessels and the representatives of the steamship-lines as well as by the numerous custom-house and police-officers with whom I have come in contact. Valuable and constant aid has been received from officers of the customs at the Barge-office. The occasional assistance of a revenue cutter, for which the Board is under obligation to the Collector of the Port, has facilitated the duty of boarding vessels in the stream.

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[*] (*Sec.* 166, *Code of Health Ordinances.*) No owner, agent, or consignee of any vessel or cargo, and no officer of any vessel (in respect of either of which vessel or cargo a permit, according to any law, ordinance, or regulation, shall or should have been obtained to pass quarantine, or to come up to the water-front of the city of New York or Brooklyn), shall unlade, or land, or cause to be unladen or landed, such cargo, or any part thereof, in either of said cities, without having first received the written permit of this Board so to do, and for the city of Brooklyn such permits shall be obtained of the Assistant-Sanitary Superintendent at the Court-house in Brooklyn, and for the city of New York, of the Superintendent of this Board at number 301 Mott Street.

[†] (*Sec.* 25, *Rules and Regulations.*) No vessel, or ship, arriving at the port of New York, with emigrant passengers on board, or arriving at said port from a place where disease, subject to quarantine, existed at the time of departure of said ship or vessel, or which shall have arrived at any such place and proceeded thence to New York, shall receive a permit from the Board of Health to come to the docks of New York or Brooklyn, until the Sanitary Superintendent, or the Assistant-Sanitary Superintendent for Brooklyn, as the said ship or vessel may desire to proceed to the one city or the other, as the case may be, shall in person or by some Sanitary Inspector have boarded said ship or vessel, and examined carefully every person on board, and become satisfied, from such examination, that there is no person on board of said ship or vessel having any contagious or infectious disease, which might be communicated to any other person or persons.

Sanitary Dangers from Emigrant Vessels.—The system of transatlantic emigrant transportation involves so many interests, pecuniary, domestic, and political, that its details cannot be viewed in the spirit of hasty and inconsiderate criticism. Bringing under its influence great numbers of the people of the most enlightened nations of Europe, it takes them up with all their family possessions and sets them down three thousand miles away on an alien shore. The physical difficulties of a long and arduous voyage are successfully overcome, and the crowded human life between the decks of an ocean-steamer is supplied with water, food, and medical care, with the precision of a regiment in camp. The well-appointed steamers of the British and Continental lines constitute a service which has attained a high degree of efficiency, securing to the emigrant speed, economy, and a tolerable degree of safety.

Number of passengers arriving at New York by emigrant vessels:

1864......................	184,700	1867....................	245,491
1865......................	200,031	1868....................	216,623
1866......................	236,641	1869 (10 months)........ .	227,147

The passage through the city of these hundreds of thousands of travellers from all parts of Europe is naturally viewed with solicitude as an element most seriously affecting the public health. Nowhere in modern times can we find a parallel to this vast movement of human beings, except in the periodical pilgrimages of the heathen populations of India, where millions of creatures assemble under the impulse of devotional excitement, and, by an ignorant disregard of sanitary principles, communicate and multiply the germs of epidemics which are spread over the continent by the moving masses. To prevent similar germination and transportation of epidemic perils by the vast mass of emigrants constantly deposited on our river-front requires the persevering application of the best resources of sanitary science.

The following table is compiled from the Annual Reports of the Commissioners of Emigration, the Annual Reports of the Quarantine Commissioners, and from data received from the Health Officer:

	1864.		1865.		1866.		1867.		1868.		Year ending Nov. 1, 1869.	
	Vessels.	Passengers exposed.	Vessels.	Passengers exposed.	Vessels.	Passengers exposed.	Vessels.	Passengers exposed.	Vessels.	Passengers exposed.	Vessels.	Passengers exposed.
Small-pox ..	39	17,972	28	14,000	20	8,705	27	13,956	17	10,315	28	22,058
Typhus fever	5	2,955	3	1,025	2	576	4	2,052	6	2,479	17	7,367
Cholera.....			4	2,000	18	7,521	6	2,849	1	543		

Want of Ventilation Between Decks.—Epidemics have always exerted their malign power most actively where ventilation and cleanliness are most neglected. The passenger-deck of an emigrant vessel, therefore, seems to be a most appropriate field for efficient sanitary measures.

Almost every vessel bringing emigrant passengers is provided with some ventilating device introduced at more or less expense, and with greater or less success. To ventilate a vessel for fair-weather sailing is comparatively easy, but to provide a gentle and uniform circulation between decks when the storm is raging without is a difficult problem. We have only to imagine a gale that shall last for twenty-four hours. The air-ports are secured to begin with, the wind-sails are lowered at the first flurry, the side-lights, which in the Inman steamers give floods of light and air in fair weather, are closed when the first wave leaps into the gangway, and when the hatches are battened down perhaps twelve hundred people are on the first and second passenger decks depending for a day and a night on two or three doors swung open to leeward for their only supply of fresh air. Such a gale may befall any crowded emigrant ship, and only that vessel whose ventilating shafts are sufficiently elevated and strong enough to stand the weather can preserve her precious freight from disease and death.

Filth between Decks.—The question of cleanliness between decks depends on the character of the passengers themselves, on the number and accessibility, in rough weather, of the water-closets, on the number of the steerage-stewards, and, more than all, on the efficiency of the captain, who has it in his power, if so minded, to keep the darkest hole in the lowest passenger-deck clean and sweet. The steerage-stewards average one to about one hundred passengers, an absurdly small complement in view of the condition of the emigrant—sea-sick, home-sick, and on salt water for the first time. Personal carelessness is probably the main cause of uncleanness in emigrant vessels. A thorough ablution and a suit of clean clothes should be required at the port of embarkation. It is possible to carry steerage-passengers in such a manner that they shall be as secure from epidemic disease and as free from the liability to impart disease as the most favored cabin-passengers.

It is difficult to convey in words an idea of the filthy condition of the passenger-decks on some of the finest emigrant-steamers arriving at New York. The best moment for inspection is when the passengers have departed with their baggage and the vessel is about to go to her pier. All the unclean material which neglect has allowed to accumulate on the voyage, in, and under, and around the berths, is then brought to light. The berths and bulkheads are seen to be dirty and greasy; the air is close and offensive; the deck is black and slippery with muck, and encumbered with fragments of food, soiled bedding, discarded utensils, and filthy, cast-off garments. In this condition the vessel, which has, perhaps, brought cases of small-pox or typhus fever in her steerage, approaches her pier in a thickly-peopled portion of the city. No sooner is she made fast than she is boarded by persons offering to purchase and remove the heaps of refuse beds which are discarded by the passengers and left between decks.

Refuse Steerage Bedding.—The trade in refuse ship's bedding is conducted in a reckless manner and exposes the city to the dangers of communicable disease. In several instances apartments in tenement-houses have been found filled to the ceiling with worn and soiled beds from emigrant-steamers. The profits are made by renovating them, with more or less care, and exposing them for sale, or by applying the sacks and the straw to various purposes of thrift or economy. In many cases the beds are thrown overboard, either in the upper or lower bay, and are carried about by the tide and wind till they go to sea or come on shore and fall into the hands of the rag-pickers. Under your authority I have caused to be burned in ships' furnaces the refuse steerage beds of eight steamships. This bedding, amounting to 2,200 beds (burlaps and straw), had become dangerous by exposure to the infection of small-pox.

Necessity of cleansing Emigrant Vessels.—The dangers that assail public health in the direction of emigrant transportation are to be averted only by measures based on a more comprehensive view than any that finds expression in the existing methods recognized by our Government. Not only at the narrow gate of the city should the guardians of the public health keep watch and ward; they should be present at the building of the ship, to modify its construction; in the hold, when the cargo is stowed, to insure cleanliness; on the upper decks to secure light, air, and convenience; at the embarkation, to enforce personal ablution and other preparation for the voyage; on the pasage, to guard against unforeseen dangers and to correct the errors of indolence and indifference; and, when the watchful eye has done its duty at quarantine, absolute cleanliness should be the prime condition on which the vessel is allowed to approach her pier and become for a time a constituent portion of the city.

Yellow-Fever Vessels.—On several occasions I have been directed to make inspection of vessels arriving from West-Indian ports and applying for permission to come to pier. The inspections thus made were twenty-six. The sanitary condition of these vessels has to all appearances been good. The hard-earned experience of Gulf traders has taught them that cleanliness in every part of the ship is essential to health. Their vigilance is reënforced by the severe restrictions of quarantine. The result is seen in a hold and between decks thoroughly scrubbed and purified with lime.

In cases where vessels, after exposure to the infection of yellow fever at the port of departure, have been detained for repairs or taken on the "ways" in the metropolitan district, especial care and watchfulness have been observed. The sanitary conditions of the vicinity have been noted and rolls of the men employed, with their residences, have been preserved.

Fruit-Vessels.—In regard to the perishable fruit imported from the tropics, a certain degree of watchfulness and care has been exercised during the hot season. A few peremptory orders issued by your authority in the month of June arrested the sale of a number of loads of decaying and injurious fruit, and impressed the leading dealers with the necessity of withholding samples which had seriously advanced in the process of decay.

The importance of this traffic, in its bearing on the public health, may be seen from the following statements received from Messrs. Bostwick and Winslow, Customs Inspectors, at Burling Slip: The fruits from West Indian and Central American ports is brought almost exclusively by sailing-vessels, and is all delivered at Burling Slip, between Piers 21 and 22 East River. In the first ten months of 1869 the consignments were: bananas (bunches), 224,000; cocoa-nuts, 3,980,000; pineapples, 3,353,000; oranges, 8,568,000. The loss by decay was one-third in bananas and pineapples, one-fourth in cocoanuts, and fifty-four per cent. in oranges. This great mass of fermenting vegetable matter is transported by lighters and dumped in the shallow water of the bay below Communipaw. A portion floats away with the tidal currents; the residue contributes in a manner to the filling up of the Jersey Flats.

Seamen.—The reckless habits and vagrant propensities of sea-faring men, as well as the unsanitary condition of the portions of the city in which they lodge, make them peculiarly liable to become the medium for the spread of contagious and infectious diseases. The services rendered by the sailor to commercial and national prosperity, his exposure to danger and suffering, his romantic and generous disregard of self, and his freedom from domestic and conventional restraints, points in his character and history that have thoroughly enlisted the philanthropist in his behalf, are so many reasons why his sanitary condition should be faithfully studied.

Sailor Boarding-Houses.—The great majority of sailors arriving here have no home in the city but the sailor boarding-house. An inquiry into the manner in which these houses are conducted has given results which may be presented as follows:

Inspection has been made of thirty houses, selected at random, in the 1st, 4th, 6th, and 7th Wards. Leaving out the "Sailors' Home," and the "New Sailors' Home," which, together, can give accommodation to 265 boarders in 120 rooms, the remaining 28 houses can receive in their 149 rooms 668 boarders, an average of four or five to each room. Ten of these houses, when full, accommodate in 34 rooms 304 boarders, an average of nine to each room. In sixteen houses the upper floor only is given to lodging-rooms, the rest of the house being let to tenants or occupied by the family. A bar for retail of liquors is kept in six houses. The absence of heat and of carpets in the lodging-rooms is universal. In twenty-three houses the rooms contain no furniture beyond the beds, which present great variety in material and cleanliness. Ablution is performed by the boarders in the yard in fifteen houses; in common wash-rooms in ten, and in the kitchen in four. In one house only (New Sailors' Home) is it practised in the lodging-rooms by means of basin and caraffe. There are free bath-tubs in six houses. The affairs of the kitchen, in these houses, appear, as a rule, to be managed with regard to strict economy and neatness. The price charged in every case is not less than one dollar per day.

The absence of the luxuries found in boarding-houses of a better class is not to be reckoned an evil or an abuse. It accords with the hardships and physical endurance which belong to the sailors' occupation. The great evil of the system is that it exposes the sailor to the temptations of all the degrading and destructive vices and crimes, with none of those strong defences which are found in the ties of friendship, home, and citizenship. The diseases and deaths that are witnessed at the Seamen's Retreat, and among the sailors admitted to the New York and Brooklyn City Hospitals, are probably, in a very large proportion of cases, the sad results of careless and sinful living.* To give the homeless sailors of our

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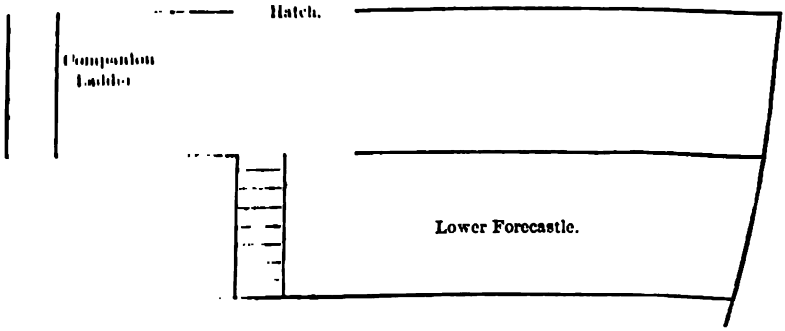
* "Out of our whole mortality list, consisting of seventy-seven in number, I can single out but ten cases which afforded any thing like a fair chance for the successful exhibition of remedies; the balance

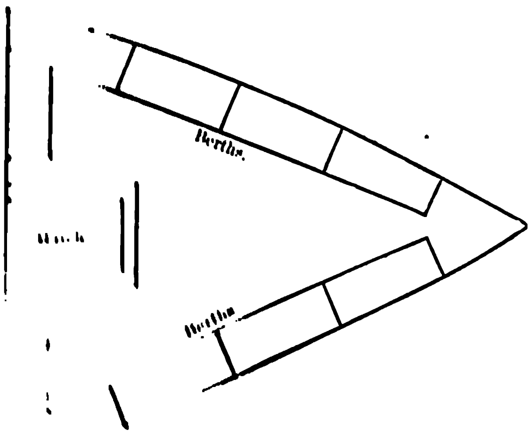
our friendly recognition and the evidences of human sympathy is to give them much-needed moral support and protection against numerous and preventable forms of sickness and death. This is not the least of the good results achieved by the American Seamen's Friend Society, and all other associations having in view the religious and social improvement of seamen.

Medical Care of Seamen.—The care of sick and disabled sailors at the port of New York is committed to the Seamen's Fund and Retreat, the New York Hospital, and the Brooklyn City Hospital. In 1868 there were treated at the Seamen's Retreat 1,049 patients, at the New York Hospital 1,513, and at the Brooklyn City Hospital 1,001 seamen. The number of sailors receiving gratuitous treatment from the physicians of the dispensaries is estimated as follows: New York Dispensary, 225; Eastern Dispensary, about 200. The Sailors' Snug Harbor, established and supported entirely by private munificence, "for the purpose of maintaining and supporting aged, decrepit, and worn-out sailors," has an average population of 420

It is to be regretted that the records of the dispensaries do not present more exactly the condition of this most interesting class of patients. The published reports of the Brooklyn City and the New York Hospitals are unfortunately defective in their method of presenting the statistics of their sick and disabled seamen. Sixty-two per cent. of all the patients treated at these two hospitals in 1868 were sailors, whose hospital expenses are charged to the United States Government. Valuable deductions regarding the diseases and mortality of sea-faring men would be available if their records were kept separately from those of



Section of Forecastle of S. S. Helvetia



[illegible] *S. S. Helvetia.*

[illegible] induced by starvation and cri[illegible] neglect [illegible] seamen on shore, [illegible] could [illegible] 1856.

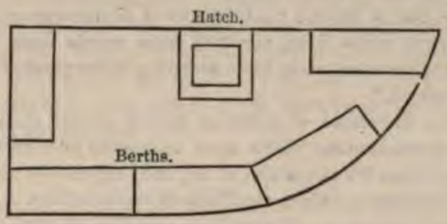
other classes of patients, and if this class of statistics were elaborated with the scientific care shown in the Annual Reports of the Seamen's Fund and Retreat.

Sanitary Condition of Forecastles.—The sickness-rate among seamen is probably greatly augmented by the want of light and air, and the presence of dampness and filth so often observed in the forecastles of even the largest and best equipped sailing and steam vessels. The following notes from my inspections of emigrant vessels will present some of these sanitary defects:

Steamship "Helvetia," 3,327 tons, lower forecastle 27 feet from stem to bulkhead, 24 feet in width at bulkhead, 7½ feet between decks. Light and air admitted by a hatch, 6 feet by 4 feet, and two air ports, each 9 inches in diameter, and which are closed at sea. Occupied by 28 men from both watches. Very dark; wet from leaky decks; air close and offensive.

Steamship "City of Antwerp," 1,625 tons. Upper forecastle, sailors' quarters on the port side approached by a narrow and circuitous passage by stooping under a portion of the anchor machinery. Light and air admitted by passage of entrance, a 4-inch stove-pipe hole and 5 air-ports, open only in smooth weather. Occupied by 22 men, in two watches. Dark and damp; air close and offensive. Berths, bulkheads, and deck, in a dirty condition. The firemen's quarters on the starboard side are similar to those of the seamen on the port side, but exposed to the further annoyance and offence of proximity to the passenger water-closets.

Ship "Constantine," 1,280 tons. Lower forecastles for starboard and port watches, 23 feet from stem to bulkhead, 10 feet wide at bulkhead, 7 feet between decks. Companion-way steep and difficult. Light and air admitted by companion-hatch, 30 inches square, and two air-ports, closed at sea. Ten berths in two tiers. Dark and damp; air close and charged with offensive ammoniacal odors. Bulkheads and berths black for want of scrubbing. Deck slippery with filth.



Plan of Starboard Forecastle of Ship Constantine.

Ship "Alexander H. Marshall," 1,493 tons. Lower forecastle. Light and air admitted by a companion-hatch, 36 inches in square, two deck-lights and four air-ports that do not open. Nine men in a watch. Dark and damp. Air close and very offensive. Berths, bulkheads, and deck, in a filthy condition.

To neglect the sanitary care of a ship's company shows a want of foresight which is not in keeping with the vaunted thrift of successful business-men. Short voyages, the preservation of spars and rigging, and the safety of costly ships and human lives, depend in a fair degree on the physical condition of the crew. The ship-owner who wishes to guard his ventures against disaster by the use of all reasonable precautions, must shelter his crews in light, clean, and airy quarters, and take a personal interest in the treatment of the men. In the hundreds of total wrecks and disappearances occurring annually, if the actual truth in each case were ascertained and acknowledged, it is reasonable to suppose that an alarming proportion is due to the reduction of the working power of the crew by unhealthy quarters, unreasonable overwork, and, in some cases, by maltreatment.

Cruelty to Seamen on Shipboard.—Instances of cruel abuse of the irresponsible power given to officers are sufficiently common to have a serious effect on the physical condition of sailors as a class. The following are the statements of Dr. Thomas Clarkson Moffatt, after fourteen years' service as physician-in-chief of the Seamen's Fund and Retreat: "We have been witnesses, during the past year, of the brutality which is so fearfully common at sea, and upon which we have commented in these reports in former years. If but a small part of the statements which are made by the poor, mutilated sufferers who come under our care

[illegible] and radical reform is urgently needed
[illegible] marine. . . . . It is the undeniable
[illegible] in some vessels for the officers to 'work
[illegible] of them in inclement storms, by over-
[illegible] them glad to run away from the ship as
[illegible] balance of wages may be due them."

[illegible]—The evil results of sanitary neglect, of
[illegible] ship, are not often recorded. Unfor-
[illegible] are best able to report facts of this class
[illegible] shows concern for the men who died on the
[illegible]: "The horrors of the sea have never
[illegible] of a countless multitude of unhappy and
[illegible] ship, and to the interest of her owners, re-
[illegible] disagreeable or injurious nature. I will but
[illegible], last spring, brought a case of confluent
[illegible] concealment of the patient in the lamp-room.
[illegible] return of the number of deaths occurring
[illegible], in 1866, by Mr. T. W. C. Murdock,
[illegible] Board, to our Commissioners of Emigration,
[illegible] have at present no means of obtaining the
[illegible] or brokers of the ships themselves; and
[illegible] of their returns, yet their interest in
[illegible] it is impossible to receive them with entire
[illegible] from the last annual report of the Health
[illegible] as can be ascertained, fifty-eight cases, and
[illegible] upon vessels from the different infected
[illegible] at the ports of departure, and on the

[illegible] correct returns from vessels, stands in the
[illegible] necessarily precede reform in the present
[illegible], and suggests the need of a system of vital
[illegible] marine affairs.

[illegible] condition of piers and bulkheads, and of
[illegible] to time received attention and been the
[illegible] the sanitary condition of the water-side pur-
[illegible] reduce the rate of mortality among the peo-
[illegible], but more especially as it would estab-
[illegible] against imported pestilence. In the
[illegible] districts started from Old Slip as a centre
[illegible] Street in the latter year.—(*Dr. A. H.*
[illegible] at this day most noticeable features in
[illegible], but also of the entire water-side, are
[illegible] of the germs of infectious diseases. By
[illegible] dryness and cleanliness, the water-front,
[illegible] become a strong line of defence.

[illegible] that portion of the river-front most com-
[illegible], North River, to Corlear's Hook.
[illegible] to Pier 47, North River, and from Pier
[illegible] inspections, followed by report, have been
[illegible] required.

[illegible] the surface of the piers and bulkheads
[illegible] discreditable. A few bright exceptions
[illegible] Among the causes of the almost
[illegible] and transient character of the struct-

ures, the division of responsibility, and the apparent absurdity of keeping piers and bulkheads clean and tidy when the adjacent streets and gutters are so shamefully neglected.

Of the thirty-one piers which have been systematically inspected, eight presented large broken holes in the rotten planking, which put life and limb in constant peril, and fourteen were in such a state as to prove that, if public *latrines* are to be established, the proper place for the first fifty is on piers and bulkheads.

Lighting and enclosing Piers and Bulkheads.—The absence of gaslight on the piers and bulkheads increases the insecurity of human life. Around the water-front from Christopher to Grand Street, the number of lamps on the side of the street toward the river is seventy-four. These in every case belong to individuals or private companies, and give occasional or imperfect light.

The necessity of providing light is greater, from the ruinous condition of many of the structures on the water-front and from their peculiarly unguarded and exposed position. Of the 214 piers and bulkheads in this section of the water-front, 69 are securely enclosed by gates which are locked and watched at night, 10 are partly enclosed, while the remaining 135 are entirely open, without railing, life-line, or any other device for the security of unwary passers-by. The perils of such a locality are multiplied tenfold when darkness hides the pit-falls in the crumbling planks and obscures the dividing-line between safety and danger.

The advantages to be obtained in point of security by guarding the approaches to the water may be inferred from a comparison between the North River from Battery Place to Christopher Street, with the East River from Battery Place to Grand Street. Most of the piers and bulkheads on the North River, being occupied by domestic and foreign steamship lines, are fenced in on the street and closed by gates; while on the East River the piers and bulkheads are left open and unguarded to suit the convenience of canal-boats, coasting-vessels, and sailing-packets. It appears from an analysis of the reports received at Police Headquarters for the year ending November 1, 1869, that by far the greater number of persons fell into the water along that section of the water-front that is the least protected. The figures are given in the following table.

	Open piers.	Closed piers.	Open bulkheads.	Closed bulkheads.	Persons overboard and rescued alive.
North River, 52 piers......	13	39	30	21	29
East River, 56 piers.......	48	8	44	11	67

West Washington Market.—West Washington Market, which occupies the water-front on the North River from Pier 20 to Pier 25, has been the subject of examination and report. Although the principal market of the city, it is so unsightly and filthy as to be the jest of the travellers and seafaring men who land from vessels at the piers on that side of the town. It is pervaded by the poisonous and disgusting airs from a sewer mouth opening under some of the stalls, and is in the immediate vicinity of a dumping-ground which furnishes offensive odors in wet weather and in dry weather clouds of dust which are blown through the market, defiling the food exposed for sale. On account of its defective construction, it is difficult to keep clean. In warm and moist seasons a constant and offensive exhalation arises from the extensive flooring of planks, exposed to the weather and sodden with manure and refuse vegetable matter. I have seen passengers in the West Street cars trying to resist the assaults of the vile odors that come from Washington Market on one side and West Washington Market on the other, by closing their nostrils.

Dumping-Wharves.—The class of piers known as dumping-wharves present a nuisance that might be remedied by more careful management and at trifling expense. At Vesey Street and Laight Street, North River, and at Roosevelt Street, East River, parts of the city thickly peopled and crowded with business, thousands of loads of street-manure are piled up in huge mounds, increasing in value during the hot months, and awaiting purchase and removal by the farmers of Long Island and New Jersey. By giving up the formation of compost-heaps at these points, and by enclosing the piers with fences and screens for keep ing off the wind, the nuisance of offensive odors would be mitigated, and that arising from the dust entirely abated.

Neglect of Water-side Streets and Gutters.—The condition of the streets and gutters within one block of the water is notoriously filthy. I have been informed by men of travel and observation, who as officers of merchant-ships, have been familiar with the commercial sections of cities in all parts of the world, that, for dirty streets, New York City has no successful rival. In the streets in question the difficulty appears to come from the neglect of street-cleaning and the absence of proper grading. As to the first-mentioned cause, but little can be said. The dwellers in Morris Street cannot expect to have their street cleaned when the frequenters of Broadway are unable to secure the removal of the filth that disfigures that great thoroughfare.

But the defects of grading and drainage in the surface of these low streets appear not to be so generally understood. The retention of surface-water undermines and destroys the pavement, as may be seen at Piers 4, 43, and 46, North River, and at numerous other points at the entrance of piers on both the North and East Rivers, where the dilapidated pavement has been filled in with rubbish and patched with planking. In rainy weather it keeps the entire length of West Street and South Street and the adjoining blocks of all the cross-streets in a scarcely passable state, and creates and indefinitely prolongs a condition of filthiness and moisture most favorable to disease and death. Special reports have been made on the sloughs that exist between Piers 42½ and 43, at the foot of Canal Street, N. R.; between Piers 23 and 24, at the foot of Beekman Street, E. R.; and in South Street between Scammel and Jackson Streets. In the case of the vast pool of slime and filthy water that lay between Peck Slip and Dover Street, a simple wooden-box drain introduced by your direction, and the removal of a few loads of street-dirt, effected a cure in a single hour at a time when an outbreak of disease was impending in that region.

The prevention of this unwholesome moisture and much of the filth lies in a proper grading of the streets and gutters bordering the water. A dead level has been preserved where a slight inclination would have shed every drop of rain-water into the slip.

Sewer-Mouths.—The effluvium from the open sewer mouths along the water-side is believed to have a disastrous effect on the health, not only of the low-lying sections, but of the whole city. Since fatal diseases creep into dwelling-houses with the air escaping from minute defects in pipes leading to the public sewers, it is reasonable to believe that death is sown broadcast by the volumes of fetid air that arise from the yawning mouths of sewers along the river-side.

The sewer-mouth at the foot of James Street, East River, has been the subject of petition addressed to the Board. The gases and vapors that arise under the bridge of the Hunter's Point Ferry at this place are not only detrimental to public health, but are, further, a most offensive public nuisance. The paint-work in all parts of the ferry-house has suffered from the effects of sulphuretted hydrogen, certain portions showing a black, metallic lustre, in striking contrast with contiguous portions which are less exposed to the current of foul air. Specimens of the destructive effects of these gaseous sewer emanations on lead-paint may be seen at the Weehawken Ferry, foot of West Forty-second Street, also at ferry foot of West Twenty-third Street, and on the Columbia Boat Club-House, foot of Christopher Street, on the upper side of the passenger office of Pier 28, North River, on the upper side of the Williamsburg Ferry-House, foot of Roosevelt Street, and on a market building at the left of the entrance to Barclay Street Ferry. At the two latter places, finely-lettered sign-boards are so disfigured and blackened by the effects of sulphuretted hydrogen and other gases upon the lead-painting, as to be scarcely legible.

Deposit of Sewage around the City.—The solid constituents of the sewage of New York, instead of being swept clear of the city, are deposited in the slips between the piers and entangled in the infinite labyrinth of piles which makes up the system of piers and bulkheads. The sewer-mains, instead of extending to the ends of the piers, terminate abruptly at the bulkhead. At Coenties Slip, where the water of the slip makes in as far as Front Street, there are two mains which open one block inside of the bulkhead line. On the other hand, the sewer emptying at the foot of Canal Street, has a wooden trunk running down Pier 42, and discharging into the strong tidal current at the end of the pier. As a consequence, the water of the slip on either side of this pier presents the usual character of dock-water, instead of the inky color and offensive odor which betray the vicinity of a sewer-mouth. Another exception to the common situation of sewer-mouths is seen between Piers 20 and 21 North River, where the made land of West Washington Market causes the sewer of Fulton Street to empty sufficiently near the end of the pier to feel the sweep of the current. On an ebb-tide, the black masses of sewer-water roll into the light-colored river-water, and are carried down the stream, resembling volumes of smoke from a furnace-chimney.

The result of the almost universal emptying of sewers at bulkheads, instead of piers' ends, is the deposit and retention all along the river-front of beds of the most obnoxious forms of decomposing filth. This hideous formation may be observed to advantage from certain office windows in the northeastern portion of West Washington Market. At this point, a low tide exposes the bottom for about fifty feet from the bulkhead, bringing to view huge beds of sewer-mud with a black stream of sewage winding among the piles which support the market-stalls. Further evidences of this baleful deposit are found in the gradual obstruction of slips, in the black water turned up by the propellers of deep steamers, and in the evolution of gas when the compressing weight of water is removed by a low tide. On hot, summer days, bubbles of gas have been observed in such abundance as to produce, by their breaking on the surface, the spangled appearance caused by a shower of rain.

Present System of Piers and Wharves.—Reform in the system of piers and wharves is a subject that has received considerable attention from merchants and others interested in cleansing the water-sides, and increasing the commercial facilities, of New York. Propositions for a change in the manner of government control, as well as for the reconstruction in masonry of the whole line of piers and bulkheads, have been made by the best authorities in matters pertaining to civil engineering and municipal reform. With great diffidence the Inspector may be permitted to suggest that, so far as sanitary improvements are concerned, the reforms required would seem to be measurably attainable under the authorities that are at present responsible, and without abolishing the existing unsightly but adequate wooden piers and bulkheads.

The principal sanitary defects are the dirty and ruinous condition of the surface of the piers and bulkheads, the faulty grading, and imperfect draining and cleaning of the water-side streets and gutters, and the retention of the city's sewage in the slips or basins between the wharves. The owners and lessees of piers and bulkheads can, with due pressure, be led to keep their premises clean and in good repair. The grading and cleaning of streets and gutters appear to be a simple question of persuading men *to do well what they are well paid for doing.* The sewage would be at once deodorized and removed if the sewer-mains were deflected before reaching their present openings, and extended to the ends of the adjacent piers. If it is considered impracticable to extend the sewer-mains in masonry with the present system of piers, perhaps they might be supplemented by trunks constructed of wood, protected by treatment with coal-tar. In all the wood-work of piers and bulkheads, wood thus prepared has a double advantage. It resists decay and the *teredo*, and the atmosphere is free from the gases evolved by so much decomposing vegetable matter.

New York is washed on either side by an impetuous flood, in comparison with which the Thames and the Seine are rivulets. Her channels to the sea are of such generous width and depth, that the accumulated sewer deposit of many years would be inappreciable. But these magnificent gifts of Nature are not utilized. The river-front is bordered by a continuous series of stagnant pools formed by the projection of the piers on the bulkhead line. Into these settling basins the sewage of the city is drained. If it were carried out into the river a little farther, and thrown directly into the swift tidal current, its diffusion and oxidation would be effected thoroughly and immediately by the superabundant floods of river and sea water.

Respectfully, your obedient servant,

A. B. JUDSON, M. D.,
Sanitary Inspector.

NEW YORK, *January* 1, 1870.

To Elisha Harris, M. D., *Sanitary Superintendent.*

Sir: I have the honor to transmit the following report of my inspectorial labors, during the year ending October 31, 1869.

The towns of Southfield, Middletown, Castleton, and Northfield, containing the villages of Clifton, Stapleton, and Tompkinsville, now incorporated under the name of Edgewater, New Brighton, and Factoryville, Port Richmond, Bull's Head, Centreville, Richmond, and some minor hamlets, to which my sanitary duties have been confined for the past year, contain an area of about five miles square, and a population of at least twenty-five thousand.

In the village of Stapleton, the highest altitude above tide-level is 341 feet, on the north, while on the east, along the bay, tide-level is not confined to the shore-line, but may be found in many portions of the alluvial basin, in which the most populous portion of the village is situated, and also in several places in Clifton, which are so low as to be constantly flooded by the tide, or by collections of surface-water and sewage, to the great detriment of health, and pecuniary loss of the inhabitants. In these places not only is the natural drainage obstructed, but no systematic effort at artificial drainage has as yet been attempted, except by a few private individuals.

In Clifton the natural drainage is effected by a few small streams, which, after heavy rains, become quite swollen, flooding the low grounds for days with stagnant water, and the overflow of privies, etc., the evaporation of which is invariably followed by increased sickness, and mortality in otherwise manageable diseases. Here there is no attempt at artificial drainage, and obstructions to the natural drainage are numerous. The brook that flows through the centre of Stapleton, and would, if properly managed, furnish an excellent outlet to surface-water and sewage, is so obstructed as to cause not only considerable damage to property, but serious detriment to health and comfort, the houses in the vicinity being frequently flooded, and thus rendered constantly damp and unfit for healthy human habitations. Tompkinsville and New Brighton, situated on higher ground, are better drained naturally, but even here there are a few places that require the assistance of art to render them as healthy as the more favored localities. Factoryville and Port Richmond, although considerably lower than New Brighton, are naturally well drained, except in the immediate vicinity of two or three salt marshes, formed by small creeks, which are, however, susceptible of considerable improvement. Back of Port Richmond, the land about Bull's Head is quite flat and swampy, and the natural drainage, which, at the best, is imperfect, has been very much obstructed by an ancient mill-pond, of which during the past summer frequent complaint has been made to the Board by the inhabitants generally. In all those places considerable improvement can be made by facilitating the natural drainage, removing obstructions wherever they exist, clearing and deepening the water-course, by straight-cuttings, when the channels are circuitous, by making flood-gates and good stone walls against the encroachments of the tide at the outfall of the streams. At present, very little attention is paid to the natural drainage, every owner of a lot or farm seeking to extend his possessions, by every species of encroachment, which, in the end, redounds to his own and his neighbors' detriment. Examples of this sort of pernicious economy are constantly to be seen in all the villages, the natural channels being so turned and twisted, narrowed and obstructed, that they are not only useless for drainage, but rendered a standing nuisance to every one by deposits of sewage from privies, pig-pens, stables, and factories, which, for convenience' sake, are usually constructed over or near them, thus producing one of the most efficient causes of sickness, entailing loss of time and money, and in many cases originating diseases which induce premature age and death.

The geological formation of Staten Island, although somewhat unfavorable to natural drainage, owing to the presence of a dense subsoil through which water does not readily percolate, is yet eminently adapted for artificial drainage, the surface being generally high, rolling, and gradually sloping to tide-level. It is composed principally of alluvial deposits, i. e., salt marshes at tide-level, consisting of marsh mud and roots, quicksand, bluish-gray clay, sand, ash-colored clay, and stiff variegated clay, which are met with in succession down to a considerable depth; of drift deposits which contain bowlders intermixed with sand and loam, overlying granite, greenstone, gneiss, and red sandstone, all of which prevent free infiltration of surface-water, which is thus left to flow off where there is a natural outfall, or, as is commonly the case, to flood the ground, whence it undergoes speedy decomposition and evaporation, as miasma, not only in the marsh, but on high levels, where innumerable basin-shaped hollows, like volcanic formations, are constantly filled with stagnant water, and decomposing animal and vegetable substances. To remedy this, thorough, systematic drainage is the first requisite, and, where it is difficult, as in the alluvial basins, a good storm-wall against the encroachments of the tide, provided with flood-gates at the outfall of streams, and grading the surface above tide-water, would effect the same object.

Many persons, otherwise intelligent, are opposed to drainage of swamps and ponds, especially on the ground that such places are actually thus rendered unhealthier than before; but this can be obviated by disinfecting the surface chemically, or by burning the superficial sods, together with brush and leaves, and covering the freshly-exposed surface with the ashes, adding quicklime, chloride of lime, coal-ashes, or a cheap solution of carbolic acid. The ashes alone, in my opinion, would be quite sufficient, and readily obtainable.

For the purpose of illustrating the evil effects of want of drainage, and the total neglect of ordinary sanitary requirements, the accompanying map of the flooded district of Stapleton is presented, together with some mortuary statistics of diseases, mainly caused by what is popularly termed "foul air," many of which can be prevented or rendered innoxious by proper sanitary precautions. At present, the brook which runs through the village is so obstructed and narrowed in various places by public and private encroachments in the shape of houses, factories, privies, pigsties, etc., etc., built directly over it, by insufficient culverts and bridges, that, instead of being the principal sewer in the village, it is a public nuisance. The most serious obstruction is at the head of the park, which, although an ornament, is the means of flooding many of the adjacent houses, because the culvert there is not large enough to receive the immense quantity of water poured into it after heavy rains. To remedy this, the brook should be cleared of obstructions, straightened where necessary, and so divided as to flow on each side of the park, through Canal and Water Streets, by new channels. The park-sewer could be also relieved by paving the gutters on both sides of these streets, so as to carry off a considerable portion of the water which now tries in vain to pass through it.

The constant flooding of Stapleton, owing to this cause, exercises a marked influence on the health of the inhabitants, as may be readily inferred from the mortality tables annexed, most of the fatal diseases being caused by malaria arising from damp basements and house-lots saturated with sewage from overflowing privies, stables, pigsties, etc., which same sewage has, in some cases, not only saturated yards, but wooden basements and cellars, and polluted also the very wells and cisterns. Is it any wonder that scarlatina and measles should be prevalent under such unfavorable circumstances, or that cholera infantum, cholera morbus, diarrhœa, dysentery, convulsions, whooping-cough, etc., most of which can be effectually prevented by thorough cleanliness in and out of doors, and by systematic drainage, have carried off so many victims?

Total number of deaths in Stapleton for twelve months, ending October 1, 1869.....	101
Infants under one year..	28
Persons eighty and upward..	5
Of both sexes by consumption: males, 5; females, 4........................	9
Typhoid fever..	1
Typhus (from ship Foster)...	1[*]
Diarrhœa..	3
Estimated population...	5,000

The prominent causes of death among children were scarlatina, measles, whooping-cough, dysentery, cholera infantum, croup, convulsions, diarrhœa, remittent fever, etc.

Nearly all of these zymotic diseases originated in the neighborhoods indicated on the map by contour lines; thus clearly showing, by undoubted proofs, brought home to scores

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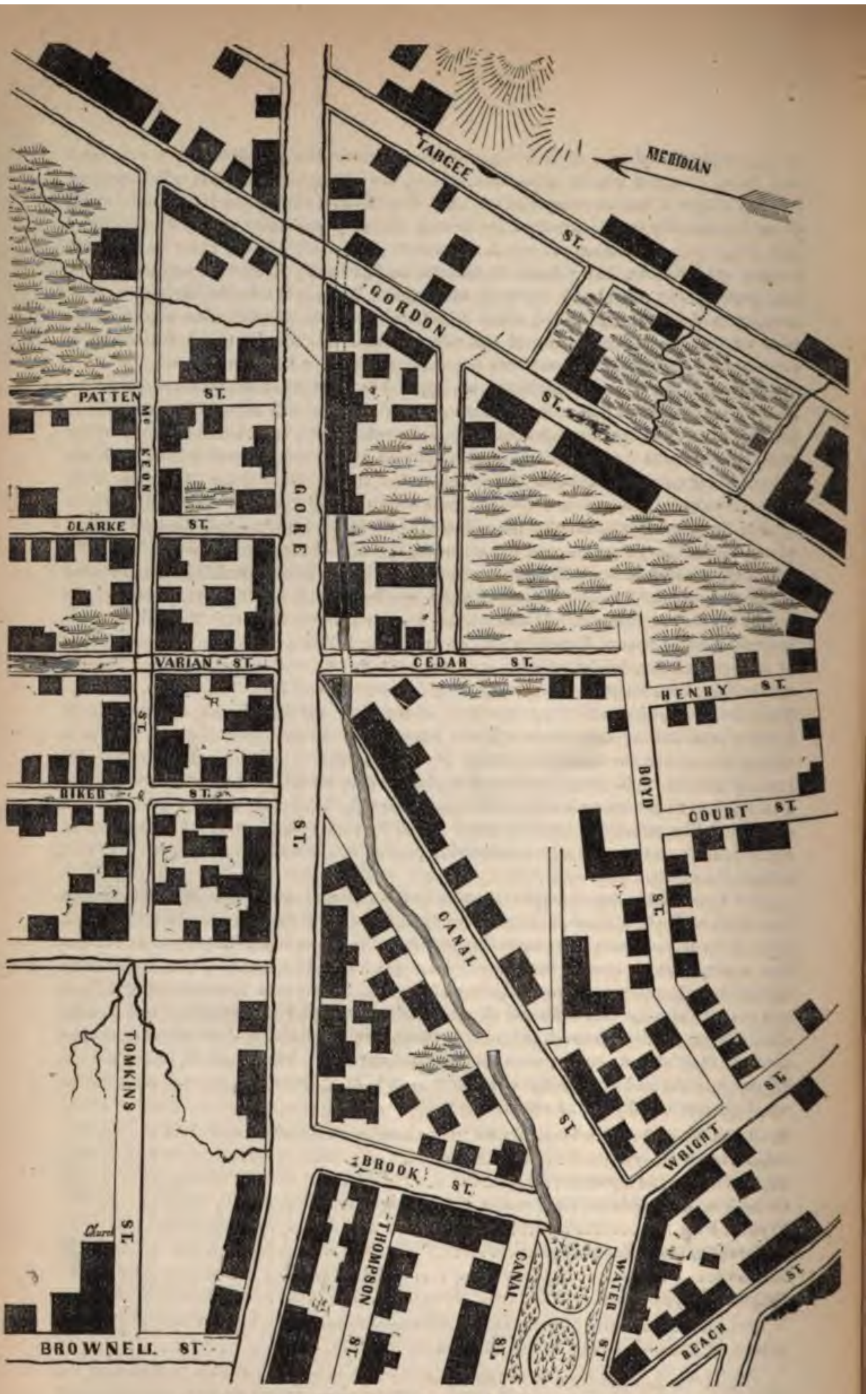
[*] Chaplain Ogle, of the Seamen's Retreat.



MAP OF AN UNDRAINED PART OF EDGEWATER, S. I.

Within the area included in this map, malarious fevers, scarlatina, measles, diphtheria, whooping-cough, convulsions, typhus and typhoid fevers, have occurred during the year, and several deaths resulted from these causes, which could be prevented to a considerable extent by drainage and proper sanitary regulations.

of bereaved families, the intimate connection between dirt, disease, and death, and the vital necessity for clean, dry houses, sewered streets, paved gutters, and macadamized roads, without which the inhabitants of all low-lying grounds are always sure to have constant visitors, in the shape of epidemics—against which human skill is powerless, when once the deadly poison has seized on a debilitated constitution.

The extent of wet and malarious ground throughout the island is comparatively large, owing to its peculiar formation. Castleton, Middletown, and Northfield, which are high, undulating, or sloping, are thus naturally drained, except at the outfall of the larger streams which flow through the alluvial basins, as at Stapleton on the east, at Factoryville and Port Richmond on the north, at Great Kills on the south, and at Fresh Kills on the northwest. Nowhere, however, is any serious obstacle presented to artificial drainage, the necessity for which is universally admitted. I believe the general experience is, that a high and dry position will not exempt the residents from the effects of malaria, which can be conveyed by the wind, from its source in the marsh, to the tops of the highest hills. Even on these there are abundant miniature marshes sufficient to account for the presence of malaria, which, in my opinion, can be generated at any height—when, on this island, the soil is such as to retain surface-water sufficiently long to undergo decomposition. That a very considerable portion of the surface of Staten Island is of such a nature is well known; and this fact, as seen, points at once to the remedy—drainage, even by open drains or ditches—precaution being taken to disinfect the swamp or pond so emptied, in the manner previously indicated. In order that this should be of any use, it must be general, malaria not being confined by fences, nor always by groves of trees—for these are known to retain it in the vicinity of dwellings—although by proper management they too can be made to help the natural drainage, by withdrawing a considerable quantity of surface-water from the surrounding surface. A familiar instance of this is constantly witnessed when extensive clearings are made by the removal of trees. Malaria is sure to prevail for years, until the ground so denuded is thoroughly drained; but trees in the immediate vicinity of dwellings render these unhealthy by the obstruction they present to the access of light and sunshine, both of which are among the first requisites of life and health. If trees are to be planted in the vicinity of houses, they should be resinous evergreens, which are better preventives of malaria than the ordinary deciduous shade-trees.

Regarding the wants of the several villages, the first and chief is a system of street-sewers, into which every one can drain his property. This is such an absolute necessity, that sooner or later it must be attended to—and the sooner the better—so as to save endless expense, trouble, and loss of health; for, as now happens, the sewage of country villages, being allowed to run at large, and pollute every thing within the sphere of its action, entails almost as much sickness as many of the crowded slums of a large city. Another cause of sickness in villages is the want of method exhibited in building habitations, these being invariably constructed with deep basements, into which, from the saturated soil, surface-water flows, in the same manner almost as springs into wells. The basements, in fact, being nothing more than damp, empty cisterns—and not empty either—for they are generally full of miasmata, generated in summer by the heat of the sun; in winter, by the action of stoves. Hence it is not uncommon to witness the effects of sickly miasms, even in the depth of winter, in the form of remitting and intermitting fevers, measles, scarlatina, whooping-cough, typhoid fever, and other similar complaints. Such houses, so built, cannot fail to be unhealthy, from bottom to top, because it is well known that water will rise, even through a cemented wall, by capillary attraction, and render the whole house damp and unhealthy. It is now known that consumption may be thus caused; and, without going very far for an illustration of the evil effects of damp basements, often saturated with sewage from privies, etc., it is only necessary to call to mind the epidemic of typhoid fever which occurred in Bay Street, Stapleton, a year or two ago—several deaths having occurred in those places especially where the houses had been flooded by filthy surface-water.*

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* In our Second Annual Report we had occasion to refer to the neglect of sanitary drainage, and the proper care of drinking-waters, in the village of Edgewater.—[See page 243, Second Annual Report, first edition.] The instances of typhoid fever, and its propagation through the wells of water in that village, seem to be repeated, in one form or another, every year. E. H.

The water supply in most of the villages is abundant, consisting of spring-water, and in the higher grounds of rain-water, which is generally filtered before it is used for culinary purposes. The spring-water is generally very pure and abundant, but in some places it is hard, in consequence of its containing iron, etc., in solution, and is thus likely to cause constipation and congestion of liver, spleen, etc. This, however, can be readily obviated by using filtered rain-water, which is the purest known after distilled water. When the spring is neglected and allowed to be polluted by sewage, it is sure to induce such derangements of the system as would furnish a ready nidus for zymotic diseases, such as diarrhœa, dysentery, typhus and typhoid fevers, etc. In connection with this subject, the suggestion of Mr. Worthen, the accomplished engineer of the Board, to collect the surface-water of the island into reservoirs for domestic and public use, similar to the Croton water in New York, is eminently practical, and would, if put into effect, not only effectually drain the surface, but furnish an inexhaustible supply for various purposes. In this way the water-tax could be made to pay for the expense of drainage, and a double benefit be conferred on the island.

But, in order to give impulse and direction to all these reforms, the influence of the Metropolitan Board is indispensable, for, no matter how anxious the local authorities may be to introduce them, petty interests and local jealousies are sure to mar or entirely defeat them; so that, in the end, people become indifferent under abuses to which use has made them accustomed. The Metropolitan Board, on the contrary, remote from local partialities, can afford to be just, and thus more effectually subserve the general interests than any number of local authorities, unless these latter are unusually unanimous in doing right. To the Central Office and its vast sources of information on sanitary subjects, surburban villages must have recourse for many a day yet to come, until each one can have a local board of its own; but, in the absence of such a consummation, every village should have a local representative of the Board to attend to all sanitary matters. As yet, there is no registry of births, marriages, and deaths, in Staten Island, and physicians' certificates are not required for burials in the county, being furnished only when bodies are to be buried elsewhere, for which a permit from the Metropolitan Board is necessary. To this important duty the local officer could also attend. Coroners' inquests, also, should be reported to the central office, but, as far as I know, they are not, being very loosely conducted in many instances. The people generally, I am satisfied, are prepared to adopt these additional requirements of civilization whenever the Board see fit to demand them officially. So far they invariably yield prompt obedience to its sanitary behests, nor is a formal order always necessary, a simple official intimation being frequently all that is required to abate ordinary nuisances. And not alone, in this respect, has the general interest been manifested, but, on the all-important subject of drainage, a healthy public sentiment has for a long time prevailed, thanks to the persistent teaching of the Sanitary Superintendent, and the great interest he has always taken in the drainage and sanitary improvement of Staten Island. That all this interest has not been thrown away, is evidenced by the fact that, at the last session of the Legislature, five or six bills were introduced for the drainage of the island, and, though none of them passed, such a general demand must have induced the Legislature to pass a general law, applicable to the whole State, of which Staten Island immediately availed herself, a commission being now at work to drain a considerable portion of Edgewater. And so eager are the people to see this commission in active operation, that frequent complaint is made to me of their apparent tardiness, showing conclusively that they look to the Board with confidence for assistance and encouragement in this important undertaking.

Résumé of Work in the Edgewater District.

Special inspections	197
Reinspections	25
Vaccinations	30
Notices served	34
Short orders served	12
Legal investigations attended	3
Burial-permits furnished	50
Special reports to local authorities	9
General inspections	2

Exclusive of the above record, innumerable verbal notices and instructions were given in my daily rounds, articles furnished to the local newspapers on drainage and other sanitary subjects, drainage meetings attended, and weekly and semi-weekly visits made to the central office, entailing the occupation of a great deal of time.

Respectfully submitted:
WILLIAM O'MEAGHER, M. D.,
Assistant-Sanitary Inspector.

CLIFTON, STATEN ISLAND, *December* 1, 1869.

ELISHA HARRIS, M. D., *Sanitary Superintendent.*

SIR: In this, my first annual report to the Metropolitan Board of Health, I propose to respond in a summary manner to the questions which interest the public health of the metropolis and its suburbs. Reference will need to be made to the accompanying map, which is here introduced to explain the malarial centres in this subdistrict. The map exhibits the chief points of special sanitary interest.

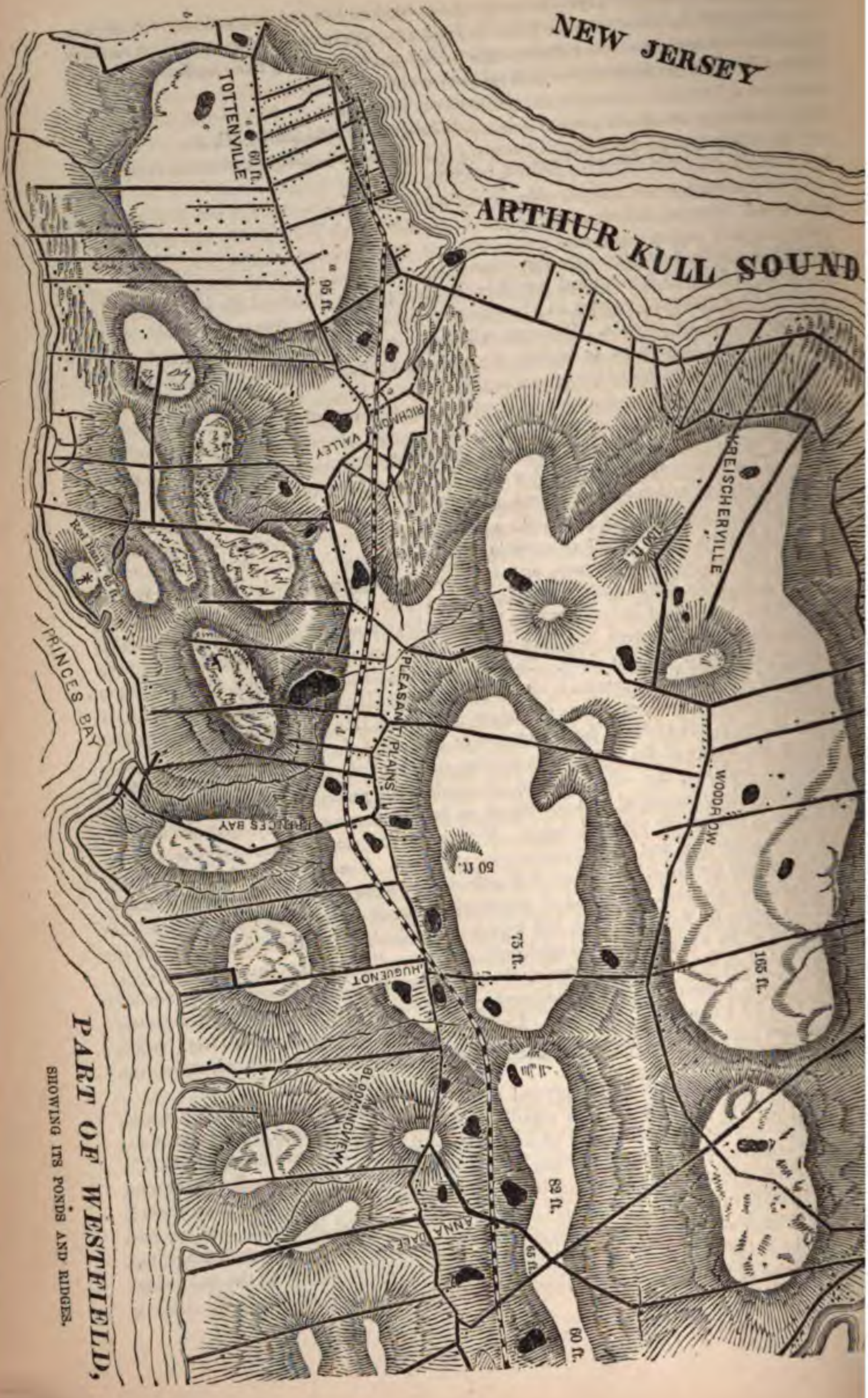
This district comprises the town of Westfield, and is the southern part of Staten Island, extending from the New York and Prince's Bays on one side to those of "Arthur Kull" or Staten Island Sound on the other or western side. This district covers an area of 14½ square miles. The estimated total population somewhat exceeds five thousand.

There are two systems of elevations or ridges which run in different directions. One commencing in the village of Tottenville and ending at Richmond Station, about one and a half miles square, which might compare to a flattened pyramid, with four sides, the apex of which is marked (*a*) upon the map, and from that point gradually descending to Ward's Point (*b*), opposite Perth Amboy, to Staten Island Sound from Richmond Station (*c*), and to the bay. The second line of elevation is a ridge beginning at Richmond Station and continuing to the northwestern boundary of the island, and having its eastern shore base nearly a mile from the bay-shore. The average altitude of these ridges, in Westfield, is nearly fifty feet above the general level of their bases. Clay and hard-pan, with masses of diluvial gravel and sand, constitute the upper stratum of this portion of the island. The surface is sandy, and varies in depth from two to fifteen feet.

From the nature of the soil, the undulating surface of the country, and the absence of systematic drainage, the water, instead of running off, percolates the earth, spreading throughout a large extent of area *beneath*, or, as seen in numerous places, *upon* the surface, and keeps it continually wet and boggy. Even upon the more elevated sections, ponds, small basins, marshes, and even quagmires, are numerous. The most favored spots, namely, the highest and the driest in any part of Westfield, are consequently subjected to this source of malarial exhalations. The want of systematic drainage has given to this part of the island its repute for fever and ague, and kept it rather thinly populated, although, except in the vicinity of its wet grounds, it is salubrious, and naturally healthy.

The principal source of disease during the past season in this subdistrict may be attributed to malarial influences. The ever-recurring intermittent fever has prevailed to a greater extent than for a number of years past. Localities hitherto considered exempt from its visitations have become notoriously miasmatic. Old and young have been attacked, native residents as well as strangers.

With a view to ascertaining the general condition of the surface-water, ponds, streams, and swampy areas that now exist, as regards their saturation with water, by request of the present Sanitary Superintendent, and upon plans furnished by him, I commenced, in 1867, a series of observations regarding the fulness and fluctuations of water in wells, ponds, etc., in my district. In submitting the plan, it was justly remarked: "If we know *where* there is special liability to epidemics, and, most of all, *why* it exists, and in what it consists, then sanitary science will triumph over many evils that now perplex us. Systematic drainage, too, must, to be in the highest degree successful and economical, be guided by the facts which such inquiries as we are now undertaking will furnish to sanitary officers." In order to



PART OF WESTFIELD,

SHOWING ITS PONDS AND RIDGES.

attain this kind of knowledge concerning the variations of the ground-water, directions were given whereby to select the best fields and localities and the proper wells for a permanent series of ground-water observations. The actual depth of the well was required by measurement from the surface of the ground to the bottom of the water; then, accurately, the distance from the surface of the earth to the surface of the water. This last kind of measurement formed the *first* of a *series* of measurements made at the same wells and same points.

The wells and localities selected will be recognized by reference to the figures marked upon the map.

The fluctuations in seven of these wells not having been marked, I abandoned shortly afterward. Certain very instructive facts appertaining to the sanitary condition of the localities, and remarkable fluctuations in the wells of the remaining eight, have amply repaid the time and inconvenience attending an accurate and regular observation of the same. These wells have been personally inspected, at brief intervals, and careful records made of their degrees of fulness, weekly, from October, 1867, to the present time.

The result of the past two years' observation, in the fluctuations and changes constantly occurring in our subsoil water, furnishes convincing evidence of the practical importance of such observations, in determining questions relating to sources of malaria, and the extent of deep drainage required for preventing this scourge of rural populations.

My attention has been called particularly to a certain locality at Pleasant Plains, marked (*d*) upon the map, where the evaporation from the earth's surface appears to be peculiarly rapid; the fluctuations of the wells and the water of a pond in the immediate neighborhood consequently especially remarkable. Situated on the borders of a tract of woodland, where there is much vegetable matter decaying, and from the pond already referred to, a prevalence of malarial diseases has marked the past two seasons.

There are certain periods of the warm season when the exhalations arising from this marshy district appear to be more potent than at others in the development of malarial fevers. By the direct rays of the sun upon this humid and alluvial earth, this deleterious material of the soil is eliminated, and clouds of mist are often seen along the surface of the fields and highways.

Persons living in this locality are more than usually susceptible to malarial influences. Intermittent fever prevails at all seasons of the year, more particularly during the drying season. Typhoid fever seems to have been confined to this locality—three cases having occurred in neighboring houses the past year, being the only cases I have any knowledge of.

In a period of two years, pulmonary consumption has claimed two victims in a house bordering on the northerly side of this pond, and another from the house immediately opposite. These persons were born on the premises where they died.

In regard to the varieties of the malarial poison liberated from the humid soil of this locality, I have observed a quotidian and a tertian type of intermittent and a case of remittent fever represented in three persons of the same family at the same time.

In view of the saturated condition of the surface of the ground, and the course of subsoil soakage, the necessity for placing in our more populous districts the wells and the privies remote from one another must be obvious—a fault sadly prominent in our villages.

The most serious case of summer cholera occurred in a patient who had been in the habit of drinking water from one of these shallow and contaminated wells, through which a strong subsoil current conveyed excremental matter from a privy situated only a few feet therefrom, and which was unprotected by any lining, either of wood or cement.

This is undoubtedly one of the most prolific sources of bowel-diseases in certain localities of the district, particularly in the neighborhood bordering on the sound—the deep-sand region.

The surface-water evaporating from our marshy grounds along the deficiently-culverted railroad, and in our public thoroughfares, produces a large share of malarial ground. It is believed that the accumulated ponds and marshes now existing are solely attributable to this fact. I refer to a single case, for illustration, upon the map, to the bodies of water and marshes marked (*e*) in the village of Tottenville. An inquiry might be made with respect to the preservation of forests and groves, as to whether their destruction or their cultivation and continuance are conducive to the salubrity of the rural districts. The effect of forests and groves in intercepting the malarial poison is remarkable; if the existence of woods is useful in a sanitary point of view, measures should be instituted to prevent the denuding of the country of forests and groves, and to encourage the planting of trees in streets and private grounds.

Rossville and Tottenville, the most populous villages of the district, have received special share of your Inspector's attention. The latter has lately been incorporated as a village, with a liberal charter. Many and important improvements have been effected by the Board of Trustees during the past year. They have been ever ready and willing to support the sanitary measures proposed by the Inspector. At his suggestion and by advice of and directions of your honorable Board, a large pond or slough at the head of the village, and bordering upon its principal avenue, has been drained, filled, and graded. Familiarly known as the "Church Pond," from its situation under the shadow of one of the principal church edifices, this stagnant body of water had for several years exerted its pernicious influence over a thickly-populated neighborhood and the people who assembled in the church before mentioned. Compared with the previous sanitary condition of this locality, a sensible reduction in the amount of malarial disease has marked this single improvement.

Vaccinations and Small-pox.—With the vaccine virus furnished by the Board of Health I vaccinated gratuitously over sixty persons, twenty-three of whom had been previously vaccinated. I offered gratuitous vaccination for all, and a ready response evinced the willingness and desire of the people to conform to this advice of the Metropolitan Board of Health, and I also furnished fresh virus to our resident physicians, seeking their aid in this important work.

During the past year three cases of small-pox occurred at "Jessup's Mills," on Fresh Kills Creek; two were very serious cases, but all three recovered. Varioloid at one time threatened to become epidemic, but it subsided as soon as a cordon of vaccination had been drawn around the centres of contagion. The cases of small-pox referred to appeared about the same time in the same house and family. Reported to me in the evening, I visited the house on the following day, together with the physician in attendance, the dwelling was thoroughly disinfected, and ample restraints instituted to prevent its spread.

I respectfully submit a consolidated statement of mortality in the village of Tottenville for the year 1869.

Total number of deaths in twelve months ending October 1, 1869.	28
" " " " of infants under one year...............	13
" " " " of persons of eighty years and upward...	3
" " " " of both sexes (of phthisis pulmonalis)....	10
" " " " of adult males " "	4
Cholera infantum destroyed	11 infants.
Scarlatina "	3 "
Estimated total population..................................	3,000

A serious demand exists in the community for a thorough system of registration. I have endeavored to preserve a correct account of the births and deaths occurring in the town of Westfield, but, unless the requirements of the Health Board are faithfully complied with, statistical information must prove ineffective and deficient.

Local inspection under the supervision of the Metropolitan Board, combining, as it does, miuute and personal knowledge of localities, and the disinterested advice and impartial authority of an intelligent power, has already produced decisive advantages over the isolated, purely local organizations. Your Sanitary Inspector's advice has been everywhere kindly received, and as the district becomes more populous, so will the necessity for a supervision, connected with a central source of authority and advice, become more urgent.

Respectfully submitted:

SOLOMON ANDREWS, Jr., M. D.,
Assistant-Sanitary Inspector.

TOTTENVILLE, STATEN ISLAND, *December* 1, 1869.

District of Newtown, Queens County.

Elisha Harris, M. D., *Sanitary Superintendent.*

Sir: I herewith transmit a report of my operations as Assistant-Sanitary Inspector in this district.

My special inspections during the year have been confined to the township of Newtown, which embraces an area of about thirty square miles. The greatest altitude in the district above tide-water is about 150 feet, at a point situated within the limits of Cypress Hills cemetery; the lowest is but a few feet, and is located in the village of Newtown.

There are but three streams which give outfall to drainage; one, running west from Winfield, empties into Newtown Creek; one, running east from Winfield through Newtown, empties into Flushing Creek; and one, running north from the swamp known as "Train's Meadow," empties into Bowery Bay.

The soil on the elevated grounds is light, with a substratum of gravel; that of the swamps and low grounds is deep, with a substratum of heavy clay, through which it is impossible for any moisture to percolate, and in consequence these grounds are wet during the entire year. I should estimate the positively wet and malarious tracts as comprising about four square miles, distributed as follows: the low ground between the villages of Newtown and Winfield, one square mile; Juniper Swamp, one square mile; and the swamp described on the map as Train's Meadow, two square miles. To these might be added as much more, and described as ponds, marshes, pockets, etc., where stagnant water is lying most of the time.

The township of Newtown has, I believe, the most unenviable reputation of any district in the State as regards its healthfulness. It would be difficult to give the actual number of cases of intermittent fever which have occurred in the town during the year, but I have been able to ascertain that, out of sixty families living within a distance of half a mile from the edges of the Juniper Swamp, forty-three suffered from malarial fever during the past year. In West Flushing, which is comparatively a healthy village, and has no such swamp in its vicinity, out of forty families, there were but ten which suffered from malaria during the same period. There are no mortuary records kept in the town, and I have found it impossible to furnish any statistics that would even approximate to accuracy.

The population is rapidly increasing, and it is estimated at present to be about 25,000. Villages are springing up in all directions, and it is necessary that the important question of drainage should receive proper attention. These new villages are frequently located in the immediate vicinity of large tracts of malarial grounds; and the health of these unacclimatized people—most of them poor—will suffer terribly, unless some steps are taken to drain these swamps, abate the dangerous nuisance, and reclaim large tracts of valuable land which are now mere peat-meadows.

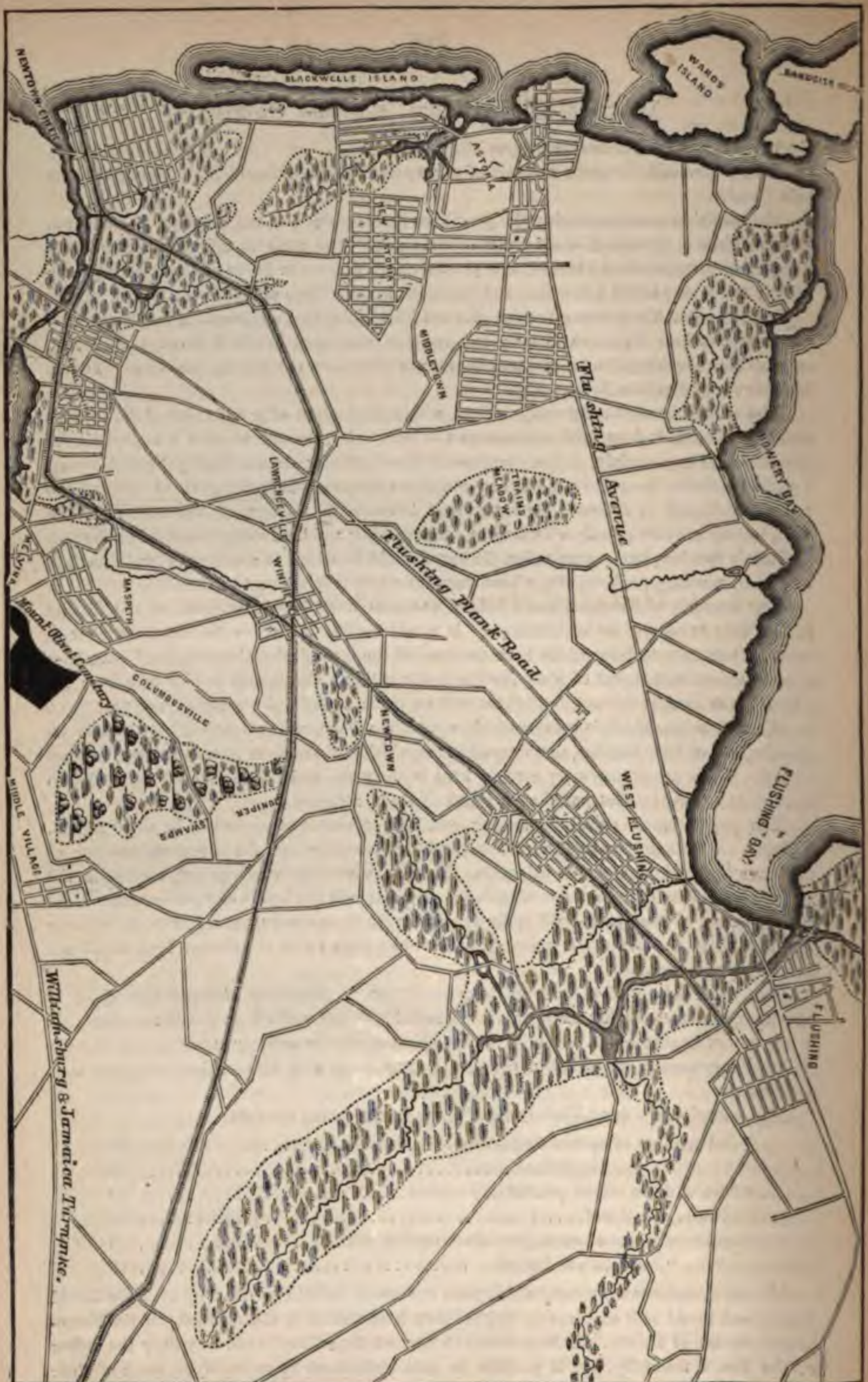
The water supply of the villages is generally good. Many use cistern-water, which is considered the purest; but the population, generally, do not suffer from the diseases incident to the use of impure water. Hunter's Point will soon require sanitary attention. They have no local government, and many of the streets are reeking with filth—swine being the only scavengers.

The following is a consolidated record of my labors during the year:

Total number of special inspections	56
" " inspections	45
Of which were served preliminary notices	20
Orders of the Board	36
Number of cases of contagious disease examined	0
" " persons vaccinated	49

Several dangerous nuisances, which have repeatedly defied the authority of the old local Board, and would still continue to defy it, have been abated by the authority of the Metropolitan Board of Health. In fact, there is a general disposition to not only obey the orders of the Board cheerfully, but, if possible, to anticipate them by so modifying some of their offensive features that they cease to exist as nuisances.

The local authorities not only render a cheerful acquiescence whenever called upon, but



MAP OF PARTS OF NEWTOWN AND FLUSHING—SHOWING WANT OF SANITARY DRAINAGE.

[NOTE.—The swampy and malarial portions of these towns are here shown to be included in shaded areas within dotted contour lines] have always shown an anxiety to assist the Inspector of the Board of Health in any effort to abate nuisances.

There is one important subject to which I have repeatedly called the attention of the local authorities, and to which I now wish to invite the notice of the Board of Health. There is no provision whatever, in the district proper, for taking care of any cases of contagious disease which may occur among the pauper population. By the terms of his contract, the keeper of the poor-house is not obliged to provide for them; and, should such cases occur, the Board of Health would be expected to make provision.

Epidemic diseases are not prevalent in this district. The malarial fevers seem to take their place, and that of all other diseases; and, if the large swamps were submitted to a thorough and systematic drainage, these diseases would probably abate; and the township of Newtown, which lies in such close contiguity to New York, would rapidly fill up with thriving villages, and there would be a vast appreciation in the value of real estate, which is now lower than in any other town within the same distance from the city of New York, owing to the notoriety of its reputation for malaria.

Respectfully submitted:

GEO. P. WRIGHT, M. D., *Assistant-Sanitary Inspector.*

NEWTOWN, QUEENS COUNTY, N. Y., *December*, 1869.

District of Morrisania and West Farms.

ELISHA HARRIS, M. D., *Sanitary Superintendent.*

SIR: I have the honor to submit the following report regarding the general condition of the sanitary district comprising the towns of Morrisania, West Farms, and Westchester, in the southern part of Westchester County, and bounded on the north by the towns of Yonkers, Eastchester, and Pelham, on the east by the East River and Long Island Sound, on the south by the aforesaid river and sound, and on the west by Harlem River.

Sanitary Topography.—The general surface of the district is very uneven, consisting in part, along the East and Harlem Rivers, of low grounds, but little above the level of tide-water, gradually rising into hills and rocky bluffs, produced by outcropping rocks, the substratum of which is gneiss. The general inclination of the land is toward the south and east, and, for the most part, arable, being susceptible of high cultivation, bearing abundant crops of grass, grain, and fruits.

Water-courses.—The principal fresh-water stream is the Bronx River, flowing through the central portion of this district, and emptying into Long Island Sound. The margin of this river, as far as tide-water, is composed wholly of salt meadows that are overflowed by high tides. From tide-water to the boundaries of this district, the banks are mostly of high grounds and outcropping rocks, having sufficient fall to produce quite a rapid current; and in several places there are factories and mills propelled by water-power, where dams are erected and a large area overflowed, causing malarial exhalations, which produce the usual results—intermittent fever.

West of the Bronx River is a small stream called "Mill Brook," that flows in a southerly direction and empties into Long Island Sound, nearly opposite Randall's Island. After heavy rains this is a rapid, turbulent stream, and is the natural sewer for the main portion of the town of Morrisania.

Between the two last-mentioned streams is one much smaller, called "Leggett's Creek," also emptying into Long Island Sound, and is the natural sewer for the surface-water of a considerable portion of the town of West Farms. It is a small rivulet except in spring and autumn, or at seasons of a great fall of rain.

On the easterly side of this district is a large body of salt water, called "Westchester Creek," navigable for steamboats as far as "Westchester Village," where a dam has been erected and a tide-mill is located. The margins of this salt-water creek are salt meadows and sedge-flats.

On the west of this district, Harlem River, a salt-water inlet, has a large area of its banks covered with sedge and salt-grass, and emptying into this river is a small stream called "Cromwell's Creek."

Sewers.—There has been a sewer constructed in the town of Morrisania, nearly one mile in length, with which the principal dwelling-houses, slaughter-houses, and breweries, have been connected. This sewer empties into Mill Brook, which has been straightened and deepened by the town authorities, near its outlet into Long Island Sound.

A small amount of sewerage has been done during the past year, in the town of West Farms.

Curb-stones and Gutters.—Many streets in Morrisania have been graded, curbed, guttered, and flagged. Several streets have been graded and sidewalks flagged in the town of West Farms, and also in the town of Westchester, the past year. Others have been macadamized thoroughly, so that no surface-water remains upon them.

Manure-vaults and Manure.—Several manure-vaults have been constructed in this district, and but little nuisance arises from that quarter.

Domiciles.—There are very few shanties in this district. The majority of the dwellings are well-built structures, the grounds being properly graded and drained. The first two years I was called upon to inspect many damp cellars, but the past year I have found very few with water in them.

Privies.—During the past year I have made a vast number of inspections, and in most cases have given a negative report.

Slaughter-houses.—Several of these nuisances exist in this district. In Westchester there are three of them; in West Farms there are five; and in Morrisania, nine. By close inspection I find they are kept as clean as the nature of the business will allow, and I have reason to believe the owners and occupants use their best endeavors to prevent any crying nuisance.

Tallow-melting, etc.—Only one such establishment is found is this district, and that is somewhat remote from dwellings. The owner has a permit from the Board of Health, and is now experimenting with an apparatus that he thinks will, in future, prevent any nuisance arising from this occupation.

Vacant Lots and Ponds.—In this district many vacant lots and pond-holes have been filled in by orders from the Board of Health, and the sanitary condition of those parts of the district vastly improved. It gives me great pleasure to inform you that I have received the active coöperation of the Board of Trustees of Morrisania, especially the Committee thereof on Public Health. Where owners of vacant lots could not be found, or refused to comply with orders from the Board of Health, the Trustees, by their committee, have executed the order, thereby promoting the public health of the vicinity.

Swine.—Very few swine are now kept in this district, and those are quite remote from inhabited dwellings.

Bone-boiling.—At present I cannot ascertain that this offensive business is carried on in this district. There was one near the west bank of Harlem River at the beginning of the year, but the Board of Health ordered its discontinuance.

Rags.—Formerly several rag-pickers resided in this district, and kept their places in a very filthy and unhealthy condition. At present I know of no such nuisance in this vicinity.

Cesspools.—The old cesspools have been filled up. It is not often that I find one in making inspections.

Cows and Cow-stables.—There are still a few cows kept in this district, but the stables are cleaner and less offensive than in former years. The manure is no longer allowed to accumulate and ferment in heaps, but is removed from the premises daily, or kept in a water-tight manure-vault, securely covered, and emptied at stated intervals. The owners of these stables are mostly Germans, and have ever evinced a disposition to comply with any regulations of the Board of Health.

Ashes and Garbage.—In some of the thickly-settled portions of the district ashes and garbage have been allowed to accumulate, but the owners thereof have cheerfully removed them when requested to do so by the Board of Health. Very little, if any, of the ashes and garbage are thrown upon the public streets.

Tenement-Houses.—There are only a few in this district, and those are now in very good order and condition. Formerly the reverse was the case, but a rigid and systematic inspection has secured less-crowded rooms, cleaner cellars and yards, and far better ventilation. There is still room for great improvement in this class of dwellings.

Vaccination.—After the publication of the notice of free vaccination there were sixty-seven children vaccinated at the several different places designated in this district.

Inspections.—The number of inspections and complaints during the past year in this district was	210
The number of negative inspections	217
The number of reinspections	146
The number of notices served	149

Besides the foregoing, inspections were made in the towns outside of this district as follows: in White Plains, New Rochelle, Eastchester, Mount Vernon, Mount Kisco, Scarsdale, and Riker's Island, in Queens County, by special orders from the Sanitary Superintendent.

The number of complaints and proof from this district was 210; the number of reports and affidavits was 146; besides several out of this sanitary district.

The number of nuisances abated in this district by order of the Board of Health was 86; also many in territory contiguous and not in this sanitary district.

Present Sanitary Condition.—Numerous vacant lots have been filled in, cellars drained, privy-vaults cleaned and disinfected, ashes and garbage removed or kept in closely-covered vaults, blood and offal removed from yards of slaughter-houses, and all manner of nuisances somewhat abated. The house and street drainage has also been greatly improved, thus lessening the mortality in this district.

Respectfully submitted:

N. K. FREEMAN, M. D.,
Assistant-Sanitary Inspector.

WEST FARMS, *December* 31, 1869.

District of Sing Sing and Town of Ossining.

ELISHA HARRIS, M. D., *Sanitary Superintendent.*

SIR: In accordance with your request, I present the following brief report of the sanitary condition of the town of Ossining, Westchester County, N. Y., for the year 1869.

The health of this town for the past year has been remarkably good. Having no system of registration of births, marriages, and deaths, a want which I deeply deplore, it is impossible to do more than to rudely estimate the vital statistics of this little district.

Topography.—The town of Ossining lies about thirty miles north of New York, and embraces about ten square miles. It is bounded on the north by the wide mouth of the Croton River and the town of Newcastle; on the east by the towns of Newcastle and Mount Pleasant, from which it is separated by the Pocantico River, a large stream that discharges into the Hudson at Tarrytown; on the south by the town of Mount Pleasant; and on the west by the Hudson and Croton Rivers.

The geological features everywhere indicate a primitive formation underlying the soil, which is made up of sand and decomposed gneiss; this rock, and an imperfect granite, a few beds of dolomitic marble, large quantities of bowlders, of various material and of every size, and sand-beds, the product of the drift period, constitute the principal materials. The soil is generally thin, and dries quickly. The surface is varied, and in places rugged, presenting a gradual elevation from the margin of the Hudson River to the eastern border of the town; the ranges of hills having an altitude of from two hundred to a thousand feet above the tide-waters of the river.

The town is abundantly watered. There are nowhere to be found, in the town, lakes, marshes, or stagnant ponds. The numerous streams are supplied by numberless springs of pure and delicious water, which are found welling up in every portion of the town.

The conformation of the surface, the direct source of the permanent water supply from living springs, the number and course of the drainage-streams, all preclude the existence of stagnant and marshy ponds.

Population, etc.—The town of Ossining contains about ten thousand inhabitants, exclusive of the fifteen hundred convicts that are within the walls of the State prison at Sing Sing.

Sing Sing is the only village in the township; it contains about six thousand inhabitants. The pauper class is very small, and cases of destitution are seldom or never known. There are no manufactories or employments carried on in the town which are positively injurious to health. The several file factories, the railroad screw-bolt factory, the iron-founderies, etc., are all large and well ventilated. The dwellings of the town are well built, ventilated, and drained.

From the facts above stated, it would naturally be presumed that the people of the town of Ossining would enjoy a remarkable immunity from diseases of all kinds, excepting such as are due to general epidemic influences, or to the vicissitudes of season or other meteorological conditions not subject to sanitary control. Its freedom from swamps, marshes, ponds, and stagnant water, the universal prevalence of springs of clear, pure water, and hence of living streams, the elevation and inclination of the surface, the absence of shops and factories in which occupations are carried on dangerous to life or deleterious to the surrounding air or adjacent water, the wealth, prosperity, and intelligence of the people, which find expression in the beauty and general neatness of their houses and grounds, and the comfort of the entire population, to all of which may be added the extreme loveliness of the scenery which all can enjoy, combine to furnish the elements and conditions most favorable to health, happiness, and longevity.

Corresponding with these facts we find that the inhabitants of this town have enjoyed a high degree of health for many years past, and that this locality has an exalted yet merited reputation for salubrity and healthfulness, and accordingly large numbers of the city population seek it for summer residence.

Your Inspector has resided in Sing Sing for eighteen consecutive years, during which time there has never been, at any season of the year, a general prevalence of any type of fever, and once only were we visited by cholera, and that to a slight degree only. Dysentery has been epidemic during a single autumn only. During the past year several zymotic diseases have prevailed to a limited extent. Diphtheria, scarlet fever, measles, chicken-pox, mumps, and whooping-cough, have affected the community, but were all characterized by mildness of type, and hence found few victims. The mortality of the whole town, from all causes combined, would scarcely exceed one per cent. of the entire population, for the year ending December 31, 1869.

The mortality at the State prison, in Sing Sing, seldom exceeds one per cent. of the whole number of convicts which it contains. In some years it is less.

The scarlet fever has prevailed in this town during the entire year, yet at no time were many sick with it. Very few cases have been fatal, and those, in most instances, were complicated with diphtheria or occurred in feeble constitutions.

No case of varioloid or small-pox has occurred in this town during the past five years.

In a community of ten thousand inhabitants it would be strange, indeed, if more or less violations of sanitary laws should not be committed, through ignorance or criminal neglect, and tolerated but for the vigilant inspection of a sanitary officer. But for such an officer, what might not be the condition of slaughter-houses, of the garbage-heaps, the sinks and sewers, and numerous other sources of impurity and contamination to the air, and even the water of wells and springs? It is not always by direct order or official interference that the principal or greatest amount of good is done in the correction of hygienic errors, but frequently, and perhaps chiefly, by the less obnoxious mode of instructive suggestion or authoritative hint by which the purpose is accomplished both promptly and with efficiency. Such has been the course which your Assistant-Sanitary Inspector has endeavored to pursue during the past year.

Respectfully submitted:

GEORGE J. FISHER, M. D.,
Assistant-Sanitary Inspector.

ELLIS PLACE, SING SING, N. Y., *December* 31, 1869.

District of Peekskill and Town of Cortlandt.

E. Harris, M. D., *Sanitary Superintendent.*

Sir: I have the honor to offer the following report of the sanitary condition of my district, and of the duties I have performed during the past year:

The town of Cortlandt, which embraces my field of inspection, lies between thirty-six and forty-six miles from the city of New York, just at the beginning of the highlands, on the east bank of the Hudson River. The surface of this township is considerably broken by rocky elevations, some of the peaks of which are from five to six hundred feet above tide-level. The general surface slopes quite irregularly from the river's edge to an average altitude of from one to two hundred feet, at a distance of one mile or so from the river's margin. Between these ledges or rocky bluffs there are, of course, depressions, or, in some, small pools of stagnant water, which are continuous, except in very dry seasons, when the water mostly evaporates.

The village of Peekskill, which is much the largest one in the township, slopes somewhat abruptly from the river to fifty feet or more above it. The village of Verplanck, about four miles below Peekskill, is on a plateau, averaging from twenty to thirty feet above tide-water.

The small village of Croton, at the southern part of the town, has a very abrupt slope from the river eastward to a height of one hundred feet and over.

The names of the principal streams running through the town are the Peekskill Creek and the Croton River, the one near the northern, the other near its southern boundary. The direction of both of these streams is from northeast to southwest.

There are some other quite small streams running nearly in the same direction, and emptying into the Hudson, most of which have their origin in springs on the hill-sides, and running with considerable rapidity to their terminus.

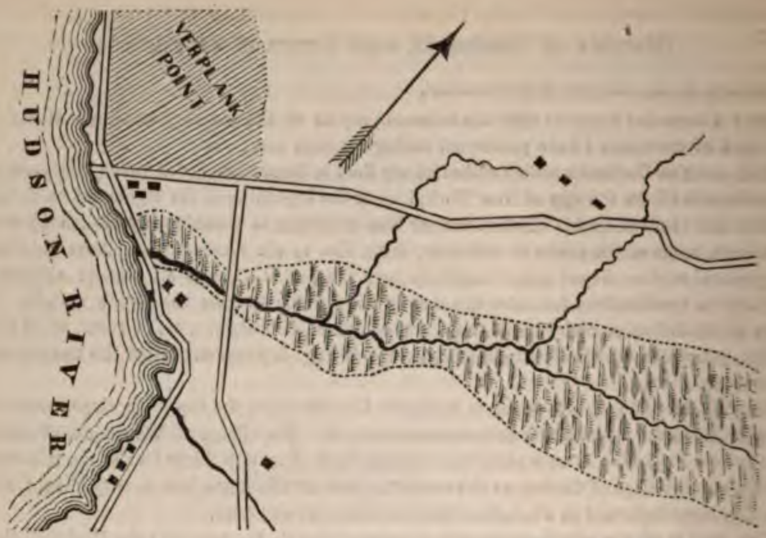
These streams in the aggregate constitute a pretty thorough drainage of a large proportion of our lands. A few limited exceptions, however, will be noticed further on.

The rocks of this region are mostly granite and gneiss, with an occasional deposit of limestone.

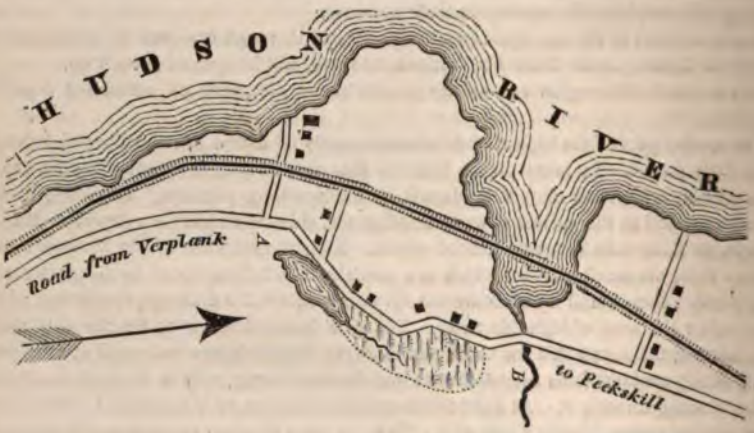
The earthy part of the higher lands consists mostly of coarse gravel and sand belonging to the drift period. In many places beneath this sandy layer, at varying depths, are deposits of blue and yellow clay, well adapted to brick-making purposes. Bordering some of the streams, and at the bottom of some small ponds, there is an alluvium deposit. Marshes, swamps, or flats, exist to a very limited extent. Near the entrance of the streams into the Hudson there are small marshes which are partially or wholly covered by tide-water at its every flood. These small marshes are not favorably located for drainage, on account of their being below the level of high-tide water. Filling with gravel seems to be the only method of reclaiming them, and this has been done to a very limited degree in a marsh at Verplanck's Point, which contains from seventy-five to one hundred acres, with a sluggish, meandering stream passing through it. At flood-tide a considerable part of this marsh is covered with water, and at spring-tide the whole of it. The following diagram represents this marsh with its accompanying creek.

The residents near this marsh are all liable to miasmatic fevers, as well also at Verplanck's Point, which is on a plateau, a little elevated above it, a few rods to the north, as represented on the map. If this marsh could be thoroughly drained, or in any other way reclaimed, it would very materially add to the healthfulness of this vicinity.

Miasmatic fevers have been more severe in the vicinity of this locality, and others like it, than in any other parts of this territory. In fact, beyond the influence of similar localities, it is scarcely to be found at all. There is, however, a small pond, without ingress or egress, receiving the washings from the surrounding slopes, and with a deep alluvium or silt at its bottom that seems to generate miasm, since the inhabitants living near it are liable to fevers of that character. But, within a hundred rods or so of this pond, it should be stated, there is a somewhat extended marsh, which is almost daily covered with tide-water, and it has been a much-debated question from which of the two sources emanates the most of the



poison. There can be no doubt, I think, that the pond produces its share, and that its thorough drainage, which can be done at a trifling expense, would add very materially to the salubrity of this vicinity. The following plate represents the pond referred to:



At the point *A* on the map a ditch three rods long and eight feet deep, or a twenty-inc tile, would thoroughly drain the entire pond and surrounding marsh. On the west of the Peekskill road, at *A*, the ground has been excavated by the Hudson River Railroad Company to a point probably six feet below the bottom of the pond, so that, with the consent of the railroad company, it is evident that the labor or expense of drainage would be trifling. The reason the drain has not been built before this is, that the company has refused to allow the water to be turned upon their property. Drainage can also be effected to the north by a ditch two hundred rods or so in length, and a part of the distance from six to ten feet deep. This route would not be at all a formidable one, and could easily be made to carry all the water into a running stream represented on the map at *B*. The dark, square spots represent dwellings, the occupants of which are all liable to miasmatic fever in some form during the latter part of every summer and autumn.

The water in this pond is from four to six feet deep at its highest, but in time of drought it is reduced to less than two feet. The mud at its bottom is about as deep as the water above it, and furnishes prolific grounds for frogs and turtles that swarm here in great abundance.

During the latter part of the summer and autumn of 1867 I doubt if one person in five escaped an attack of fever. The same remark is true in relation to Verplanck's Point, and the immediate vicinity of the marsh, represented on the map. And they are so constantly liable to an attack, that nearly all the people keep sulphate of quinine in their houses, and administer it to the inmates thereof.

The mortality from this disease directly is not very great. Occasionally it produces convulsions in children that terminate fatally, and it now and then destroys a feeble adult from congestion of some vital organ. But indirectly it destroys a larger number probably than is usually supposed, by weakening the vital powers, and thus inviting pulmonary and other forms of disease that terminate fatally.

The mortality of these neighborhoods is much larger than the other parts of our town that are non-miasmatic, but in what proportion there are, unfortunately, no data to show.

Except in the localities named, and one or two others similar, but very circumscribed in extent, the town is probably fully as healthful as any equal amount of territory in this region of country. Severe epidemics are scarcely ever seen here, while they fearfully afflict some adjacent towns. Scarlatina, however, has prevailed at Verplank's Point during the last summer, with a higher rate of mortality than has resulted from that disease in any other part of the town in twenty-eight years. Children pass through the ordinary diseases of childhood as in other places, but they increase the mortality much less than in some other towns.

During the last autumn there has prevailed in the village of Peekskill, which has about seven thousand inhabitants, an epidemic typhoid fever, of which there have been, probably, in all, about sixty cases, and five deaths, or eighty-one per cent. It is fully twenty years since the last epidemic fever before this occurred in this town, and, in seeking for the probable causes of the present one, the mind turns readily to the extreme drought of the past summer. During the months of July, August, and a part of September, but little rain fell, and the small brook that passes through the village from east to west was very nearly dry for a period of three or four weeks; and in the valley through which the stream runs, and within a short distance of it, quite a large majority of the cases have occurred. It should also be borne in mind that the wells and cisterns that furnish a supply of water to the people have also been dry; but this has been the case about equally in all parts of the village, while the fever cases have been mostly near the small stream referred to.

The aggregate mortality of our villages, town, or any section thereof, cannot be ascertained with any accuracy, since no records whatever have been kept from which any reliable data can be obtained. It is believed, however, that the average is not large, as compared with other places on the Hudson River of its size and population. The particular localities that have been pointed out as particularly insalubrious are small, with the exception of Verplanck's Point, while nearly all the rest of the town is remarkably healthy.

The total number of inspections made during the last year, that have been noted, is about fifty, while a great many persons have been seen and advised with in regard to sanitary matters, in going the round of my daily duties, of which no account has been made. Twelve informal notices, furnished by the Superintendent, have been served. Four formal complaints have been served, all of which were preceded by preliminary notices, and received the indorsement of the Board.

The number of persons vaccinated, either in person or through my agency in my official capacity, is about three hundred.

We have had no contagious diseases in the town during the year, except the scarlatina and typhoid fevers already mentioned.

The water supply of our village is entirely from wells and cisterns, except that for extinguishing fires, which is furnished by the small stream that runs through here.

One of the chief benefits resulting from the efforts of the Board of Health to the village of Peekskill is in diminishing the number of swine formerly kept. The population is now so dense that these animals should scarcely be allowed to be kept at all anywhere within the corporate limits. Previous to the efforts of the Board in the case, they were to be seen in large numbers, but now they seldom make their appearance. A very great improvement has been made also in the more perfect cleanliness of privy-vaults in various places in the village. An effort has been made to diffuse a better knowledge of hygienic laws, and the importance of obeying them among some of the people who were ignorant and careless in respect to them, and apparently with good effect. But much remains still to be done in these respects.

Some, who are neither specially ignorant nor careless in such matters, seem stubborn, and refuse obedience to any law but their own determined purpose. A salutary effect would probably be produced on such persons by a summary enforcement of the powers of the Board.

Respectfully submitted:

P. STEWART, M. D.,
Assistant-Sanitary Inspector.

PEEKSKILL, WESTCHESTER COUNTY, N. Y., *December* 7, 1869.

District of Irvington-on-Hudson, and Town of Greenburg.

To E. HARRIS, M. D., *Sanitary Superintendent Metropolitan District.*

SIR: In compliance with instructions received from your office, under date of October 9, 1869, I have the honor to make the following general report upon the sanitary condition of this district:

The Town of Greenburg, Westchester County, N. Y., forms the Second Sanitary District bordering on the Hudson River, north of the City and County of New York, under the sanitary supervision of the Metropolitan Board of Health.

This township has rectangular boundaries. It is a section of the county—the Hudson River being on the west—is abundantly traversed by streams, is well tenanted by hills, and has an average elevation of two hundred feet above the level of the Hudson River.

The entire western boundary of Greenburg is washed by the Hudson River, and the entire eastern line by the Bronx. These opposite and parallel boundaries define the two longest sides of the township. On the north, Greenburg is separated from Mount Pleasant, and on the south from Yonkers township, without such natural lines of demarcation.

Newburg is divided into two nearly equal parts by the course of the "Neperhan" or "Saw-Mill River." A subdivision is made in the lower part of the eastern section of the township in like manner, viz.: by the course of the "Sprain Brook"—a stream of considerable volume and rapid current. The Neperhan flows through the centre of the township in a comparatively straight line from north to south; its channel, descending from two hundred to one hundred feet above the level of the Hudson, is not rapid in its flow, and descends about twenty feet in its course through the district. No less than six rivulets—which never have been known to be exhausted—flow westerly, and empty into the Hudson River. About the same number flow easterly, and discharge into the "Bronx." These lateral streams have a noticeably uniform interval of separation, varying very little from a mile, at their confluence with the rivers.

The water supply of Greenburg is very abundant and unfailing, even under circumstances of a protracted drought. A well of most excellent water may be made anywhere in the township with little difficulty. In all the villages resting on the western slope of the Greenburg hills, and embellishing the shore of the Hudson, within the limits of this district, it is scarcely more than the literal truth that "*there is a spring in every man's cellar.*"

Underground water-veins, untraced, except as they well up through the chinks and crevices of shallow, rudely-constructed well-holes, will furnish never-failing supplies of the purest, coldest water to the occupants of a long line of residences in almost every part of the district. This is especially true of the village of Irvington, where one or more hidden sources and courses of water supply several private wells, and finally pour an abundant surplus for the public horse-tanks or drains by the wayside.

The obliteration of all ponds, that are not susceptible of rapid and constant renewal, is one of the sanitary needs of the district. Something in this precise direction has already been accomplished by the Metropolitan Board of Health. The great general unevenness of the land-surface, and consequent frequent occurrence of hollows or basins among the rocky elevations of a hilly country, taken in connection with the liberal water-supply, give origin to many spots which are always wet, swampy, and unhealthy for the want of adequate drainage.

The highlands of Greenburg, termed "The Greenburg Hills," lie west of the "Saw-Mill" stream, and occupy the entire space between that stream and the Hudson River. They vary in altitude from one hundred to four hundred feet above the level of the Hudson River. East of the "Saw-Mill" River the hills have very little relative altitude. Throughout the district the villages have an elevation varying from ten to one hundred feet above the tide-line of the Hudson, and private residences are often perched on or near the summits of the highest ridges. The higher lands of the eastern section undulate in directions generally at right angles with the main range of the Greenburg Hills, and are spurs of the same. There are four of these lateral lines of hills, and their elevations gradually diminish as they recede from the greater range. A peculiarity of the topography of the eastern section of Greenburg is observed in the fact that neither the valley of the Neperhan nor that of the Bronx seems to occupy as low or depressed a level as does the upper and central portion of the eastern division, lying about equidistant between these two valleys. These lower lands form a sort of valley, being wet and boggy in places, but having no visible stream to answer for the dipping or sagging outline of the surface. This valley is intersected, however, by brooks and rills emanating from springs which everywhere abound.

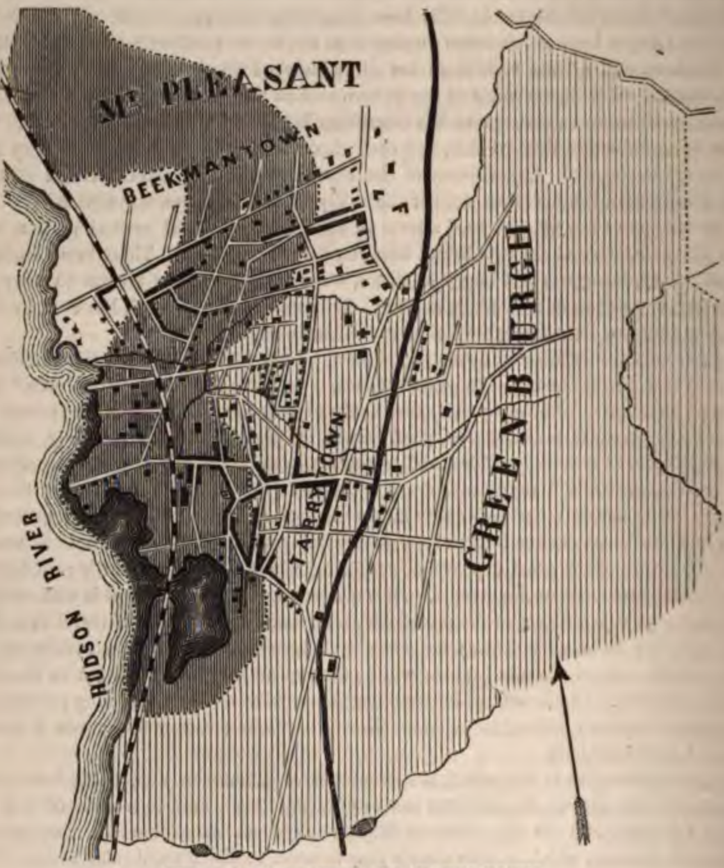
The geological formation of Greenburg does not differ from that which characterizes the whole of Westchester County. In general terms, it is a rocky base of "hard-pan," with a superficial stratum of soil composed principally of clay and sandy loam. The rocky sub-strata are composed of a coarse quality of granite in great abundance; a white, crystalline limestone, found in certain localities, and, occasionally, deposits or strata of micaceous and quartz rocks, gneiss, and sandstone of many dissimilar varieties. There is but little very rich loam of a naturally fertile quality in the district, and what there is will generally be found closely adjacent to the larger streams. Farming is not profitable, nor is it zealously pursued, because of the great expense of rendering the soil even ordinarily productive by sufficient and proper fertilizing agents. Nearly every acre of farming-land is held either for speculative purposes, subject to the prospective improvements in modes of travel to and from the city of New York, or is already for sale for village-sites, and the construction of those elegant private estates wherein expense will be devoted to adornment and not to the culture of staple products. Old farms, which have long been exhausted—the yielding powers of the soil all gone—are now waiting to be remodelled into private parks and grounds laid out in lawns and flower-gardens.

The pickle-factories of Greenburg are about twelve in number, and, being located upon the largest of the streams, are at times causes of complaints, owing to the fact of their spoiling both the water and the air whenever the stale liquor of the pickle-tubs is emptied into the adjacent streams, which is done once a year in order to cleanse and refill them. Within the last two years there has been a consolidation of this branch of business in this district, which greatly diminishes the causes and frequency of complaints against the factories for creating nuisances. Large and improved buildings have been erected, and their refuse has been utilized.

Any prevailing disposition to raise live-stock seems to expend itself in the more densely populated portion of the district, and these chiefly in the raising of swine, goats, calves, and geese. The rearing of swine and goats by the poor, in and about the villages, is the most offensive of all the nuisances in the town.

Greenburg township contains twenty-three square miles, twelve thousand seven hundred improved acres, two thousand one hundred and eighty-two unimproved acres, and possesses an elevation ranging from below high-tide level about one foot to as great an altitude as four hundred feet above tide-level.

The lowest parts of Tarrytown are at certain points below the level of the ordinary high-tide mark, and are only redeemed from participation in the natural bed of the Hudson River by a dike of made ground that forms a new and protective line of shore. This more recent line of artificial shore is reënforced by the embankment of the Hudson River Railroad, which is wide, solid, and high. The railroad has a double, and will soon have a treble track and enlarged embankment, which, until within a year, at the point above-mentioned, was practically imperforate for purposes of drainage, even of lands that were high enough to have an easy outfall whenever the natural vents are free from obstructions.



THE LOW GROUND IN TARRYTOWN.

When an inundation of the shore, forming a sort of bay, is of any considerable size, and is traversed in the style of a causeway by the railroad embankment, the culvert is never omitted; but, if these river inlets happen to be insignificant in size, so that the water they contain can in no way damage the railroad, for such as these no sort of drainage is provided. These low spots, lower than high-tide level, receiving their water from the springs of the hill-side, and by the percolation of the river-water through the soil of the outlying embankment, and having no adequate outlet, are doubtless the pregnant sources of dangerous malarial influences. Localities along the river-side, from Tarrytown to below Hastings, possessing these characteristic conditions, are too numerous, if we can point to even one. One, which may be specially mentioned (*vide* Sketch No. 2) as answering to the description given of these pent-up marshy inlets, is situated just at the foot of the classic grounds of "Sunnyside," the property of the late Washington Irving, and stretches southerly to near the Irvington depot. It is a large sweep of surface, embracing possibly ten or fifteen acres, and will be found emptied of water, leaving its mucky, oozy bottom steaming in the sun's rays, or its noxious vapors condensing and descending upon the neighborhood in the chill air of midnight, quite as often as, on the other hand, it will be found covered with tide-water, and sparkling with poetic suggestions of aquatic sports. This has been regarded by resident and local practitioners of medicine as an unhealthy locality, and personal observation, as well as local tradition, serves to corroborate this impression. Here, then, is a malarious mud-hole, created and maintained by the railroad embankment. Intermittent and other malarial fevers are known to originate in the vicinity of this flat; and sudden, and sometimes fatal collapses, observed in cases of sickness, or during the parturient function, when the course of these cases had seemed perfectly normal, and the prognosis most favorable up to the moment of supposed syncope, *but really fatal depression*, have created a feeling of dread. Few who reside in this precise neighborhood are bold enough to tarry later than until preliminary symptoms of illness, if time will permit them, to effect a removal.

* * * * * * * * * *

The map sketches which accompany this report represent five (5) of the localities especially noted for conditions considered to be adverse to a state of true sanitary excellence. They are the spots around which our physicians look for, and generally find, the cases of sickness which either spring directly from, or are essentially modified and influenced by, malarial causes. Accurate statistics are out of the question, inasmuch as no facts have at any time been classified with reference to this subject, and the labor of compilation would now be excessive, without commensurate utility. These maps are deemed sufficiently expressive, as regards region, extent, and importance of vicinage, to enable all, who will carefully examine them, to judge for themselves how unwise and dangerous it is to leave them unmolested, to continue, without hinderance, their direful and mischievous work, namely, the poisoning of the air and water of whole neighborhoods; besides creating sickness, and rendering all sickness more than commonly serious and unmanageable.

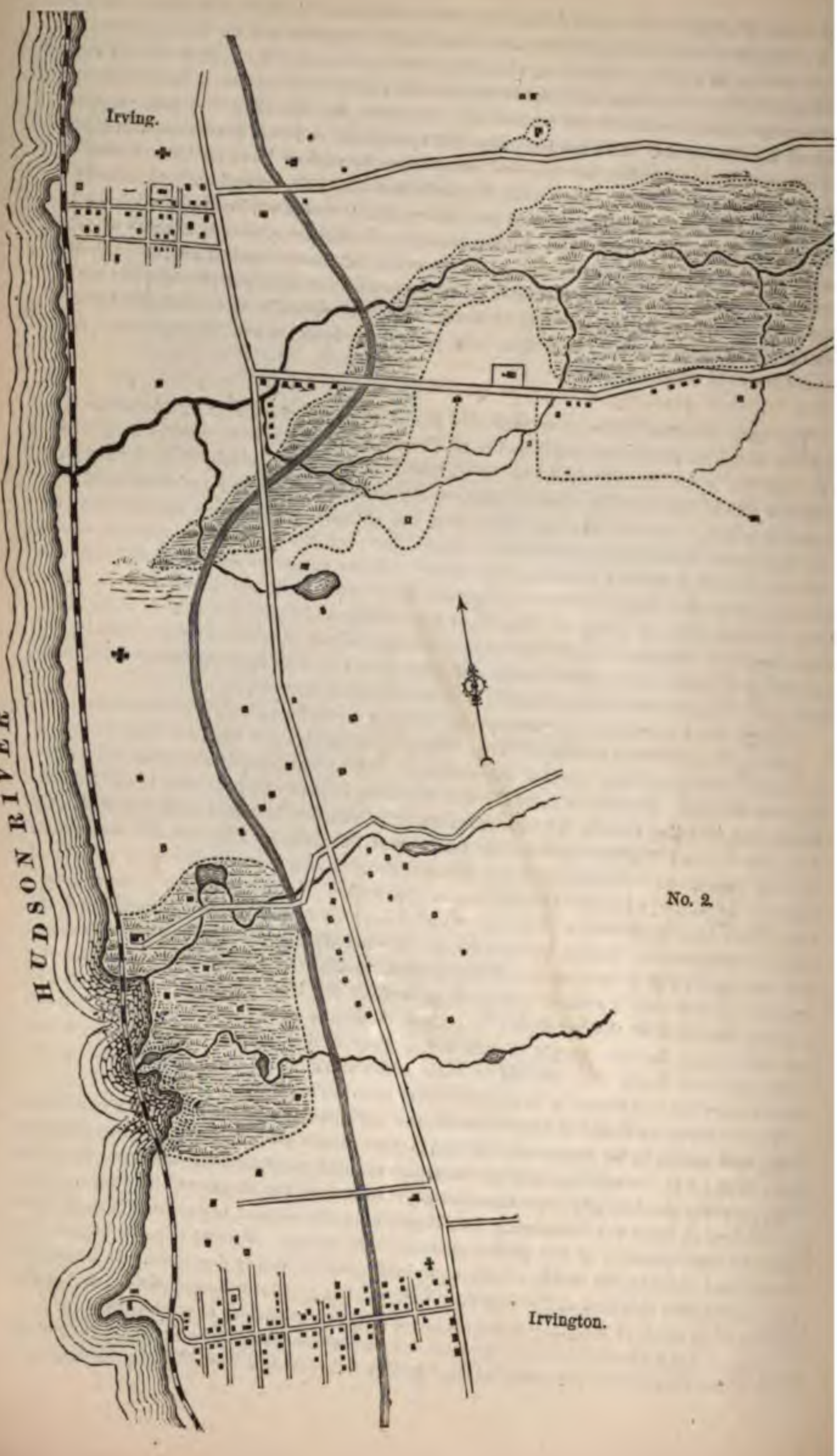
Sketch No. 2 represents the "Sunnyside" locality to which we have already alluded.

Sketch No. 5 shows a section of Tarrytown lying below high-tide level and surrounded by the most thickly-populated parts of the village, as well as being itself the region of greatest business activity. Besides its naturally wet condition, owing to its proximity to the Hudson River, and its being thereby fed with moisture by percolation, it also derives water directly from the "André Brook," which enters this section but finds no adequate and free outlet. It is no uncommon circumstance to see this spot covered with water to the depth of several inches. In winter, when the obstructions to the outflow of water are even more effectual, this hollow is quite covered with water. Stables are built over this low, wet spot, also workshops with causeways leading to their doors. These buildings are always elevated at least two feet above the present surface of the ground, to allow for contingencies. In the warm seasons this low spot is covered with pools of water. For instance, at Josephine Street, at a point southeast of the gas-works, long lines of houses upon Main and Orchard Streets are built upon the very margin of this wet, marshy section. They neither have, nor can have, cellars or yards that are not in their construction mere earth and rubbish heaps, flattened on top and fenced in to preserve them from destruction.

The Metropolitan Board of Health has caused some yards to be made that did not before exist, and others to be improved. Within a year or two past, culverts or water-channels have been let in through the railroad embankment, and some ditching has been done, but with no really good results other than the improvement of the streets and highways.

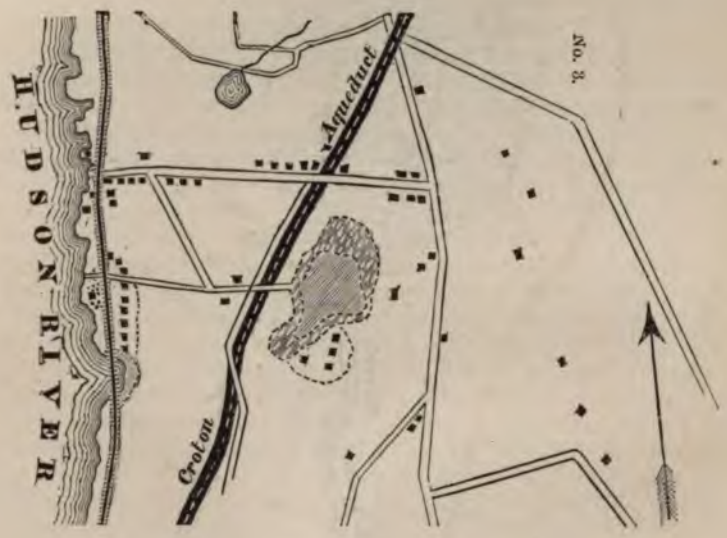
Of course, upon the surrounding heights are built the elegant mansions of the opulent, and the neat domiciles of the plainer citizens of the village. Figuratively speaking, a leap would land them in the middle of the undrained district already described. In immediate connection with this section the sketch will show a bay or inlet nuisance, similar to the one described as situated near Irvington. It has the same insalubrious characteristics.

Sketch No. 1 pictures in detail the situation and relative extent of a large plot of swampy land containing not far from fifty acres. It lies between two lines of hills, the slopes of


Irving.
HUDSON RIVER
No. 2.
Irvington.

which afford foundations for roads connecting the turnpike with the "Saw-mill River" Road. These two roads traverse respectively the northern and southern margin of this swamp, thereby giving, off-hand, an idea of its extensive breadth. This is one of the clearly-defined hill-swamp-pockets, but made more effectual as a basin by the course of the Croton Aqueduct embankment, which takes its course obstructively across its western and lowest margin. The embankment at this point is many yards higher than the ground over which it passes; i. e., the general level of the swampy flat, and retains this dyke-like character for nearly half a mile. A brook, which empties into the Hudson a little south of Irving, runs through the whole length of the swamp, pierces the Croton Aqueduct embankment, and continues on to where it unites with the waters of the Hudson. This stream alone would not cause this expanse of swamp, as it has its own well-preserved channel, and flows briskly, though at certain points it is somewhat embarrassed. Many side-rills, however, from the slopes of the steep hills on either side, furnish an abundance of the water found here, without that provident egress which is so much needed. A tongue of this swamp extends down to the turnpike, crosses the same, and dips into pleasant private property. The taste, skill, and capital, of the owners are taxed to the utmost to convert a tongue of swamp into something picturesque, useful, and salubrious. A small muddy lake is generally the grand result.

Ditches which have been freely cut, and, indeed, have served to dry a superficial layer of this swampy land, have done nothing more, as they simply collect and hold the surface-drainage, but have no place or power to discharge the same.

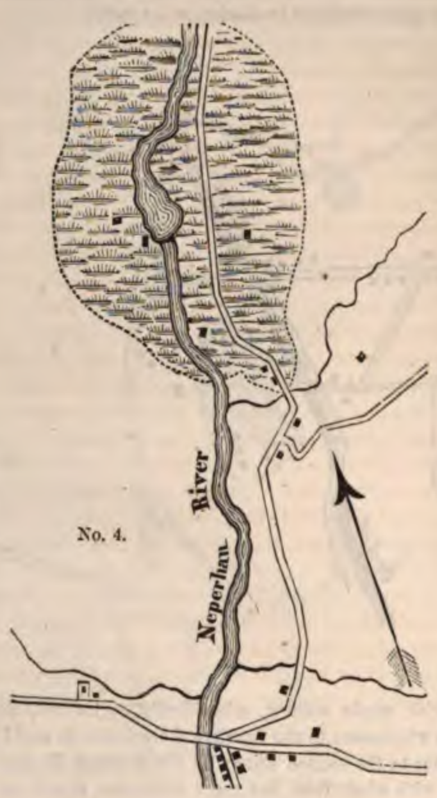


Deep drainage, with ample outflow, scientifically engineered, would soon render this section as safe and as wholesome to the dwellers thereabouts as could possibly be desired.

Sketch No. 3 relates to the section known as the Hastings Marble Quarry, with its deep, still pond, quite foul with what Time has made it receive, digest, and hold in suspension, both of animal and vegetable matter, and wholly without drainage. The quarry flanks the southern boundary of the village of Hastings, and at its bottom is situated a pond, chiefly the accumulation of rain-water. This body of water increases in quantity by the rains, and decreases solely by evaporation, there being no other way, as above stated, by which the water can escape.

The water has a greenish and impure appearance; and, when undisturbed for a few days, in consequence of the prevalence of mild, quiet weather, it becomes covered with a dense, greenish film.

Intermittent, remittent, and malarial typhoid influences radiate from the surface of this pond, and spread along the heights by which it is surrounded, and, in a manner, overhang. The length of the quarry is about two hundred feet, and the width about seventy feet. The depth is about fifty feet in the deepest part—which would be, of course, the part that holds the pond. The actual depth of water cannot be, at any point, over twelve or fifteen feet, and will probably average five. The pond itself covers about two-thirds of the area of the bottom of the quarry. The roadway, which enters the quarry at a point as near to the top as to the bottom, is made to skirt around the base of the overhanging cliffs, descending gradually, until it reaches the lowest working level; consequently, the roadway could scarcely be considered a favorable point at which to effect drainage. The road is crossed, at a little distance from the entrance to the quarry, by the Croton Aqueduct, which spans the roadway, supported by a stone arch. The syphon mode of draining has been suggested as the only practical way to empty this pond. Mr. Worthen, the engineer of the Board of Health, once suggested the establishment of a huge aquarium, to be self-supporting and self-purifying.



No. 4.

Sketch No. 4 delineates a locality more removed from densely-populated regions than any herein designated, but being, nevertheless, on the line of considerable business and pleasure travel, it is deemed worthy of brief mention. An expansion of the Neperhan, or

"Sawmill" stream, is here made by artificial means, in order to construct a small picturesque lake with which to beautify the grounds through which the stream runs, and also for furnishing water-power for grist and saw mills. This lake, though by no means still water, is commonly regarded as a source of miasmatic poisons. A valuable property has been made to change owners frequently, under the impression that it is "*a sickly spot*," and that "*it is as much as a man's life is worth to live there.*" Old practitioners, when asked about the malarial localities of Greenburg, never forget to mention this spot. The laboratory of malaria seems here to be the wet, undrained meadow-land surrounding the miniature lake. Doubtless there are other agencies—very subtle—but successful in working up toxæmic influences in this particular locality, besides the presence of water partially obstructed in its flow.

The population of Greenburg varies with "the times and seasons." The number of inhabitants is about ten per cent. greater in the summer than in the winter. It is estimated that the permanent resident population numbers eight (8) thousand. Population gravitates toward the borders and river-sides of the district.

The villages and hamlets of the district are eleven in number. Taking them in order from north to south, and then through the interior in reverse order, they are as follows: Tarrytown, Irving, Pennybridge, Irvington, Abbottsford, Dobb's Ferry, Hastings, Ashford, Greenville, Hart's Corners, Elmsford (late Hall's Corners).

That portion of Tarrytown which is known as Beekmantown lies just within the border-line of the township of Mount Pleasant. Practically, it is a very large and important section of the village of Tarrytown, and cannot well be separated from it in the exercise of official sanitary functions in the latter place.

All these villages have their sections devoted to the residences of the poor, by whom the laws of health are, of necessity, sadly neglected or directly violated.

Structures affording homes for the laboring poor are seldom found in localities which the public would deem desirable, if indeed at all fit for human residence. Hollows are commonly the sites of these poor quarters, and are as deficient in adequate drainage as they are in pure air and uncontaminated water supply. They are usually "a stench in the nostrils" of their more fortunate neighbors, who are compelled to tap—so to speak—the columns of their noisome odors as they ascend, and spread along the ridges by which they are encircled.

The poor in the villages are just as prone to keep and raise live stock, particularly cattle and swine, as are those who reside upon broad, well-appointed farm lands. It is part of their living, which they can ill afford to lose. But hogs and cows, horses and oxen, goats, geese, and chickens, if congregated in large numbers, in the smallest possible space compatible with existence, will become a great and dangerous nuisance, especially in the heated term of summer. These nuisances external to the dwelling, combined with the poisoned atmosphere of their crowded apartments, or the dampness and impure surroundings of their shanties, are fearful sources of disease to these poor people themselves, as well as a great danger to those who are their immediate neighbors.

Systematic drainage and sewerage is a subject of most vital importance in the rural districts.

Surface-water will usually find a satisfactory means of escape, but water, for which deep drainage is the appropriate remedy, must be conducted through and into proper channels, if it would be rendered harmless. To drain thoroughly, and, at the same time, to observe a reasonable economy, ought to be the mission of specially-appointed local boards of drainage commissioners in all towns and districts throughout the country. Small expenditures of time, money, and labor in the right direction, and in places not unfrequently remote from such as afford the most distinctly-apparent evidences of noxious agencies, would generally render large sections perfectly salubrious. It is scientific, systematic, and thorough drainage that is needed in this district. It is a drainage that will be so effective and lasting that no ordinary changes of road, lane, terrace, dike, or causeway, done in the interest of private property-owners, can in any way affect the general and prevailing healthful conditions of the section.

It is *deep* drainage—the work being done with a view to permanency—which is so much required. It ought not to be possible that the incessant alterations and remodelling of places by their ever-changing owners should be able to affect unfavorably, in the slightest degree, the conditions of perfect salubrity of the district.

A fact of interest with regard to this district is the great and regular influx of summer visitors and residents every year. The proportion of people who only spend their summers or vacations, or who simply visit here, is very large as compared with the permanent resident-population. The constant daily oscillation, so to speak, of so many people between the city and their homes in the country, most certainly exposes the places of their sojourn to the like malign influences, and to as many of the same as they may have passed through in their travels through the city. An epidemic of any form of disease in the city is sure to visit the country districts (at least within Westchester County) during the season, and not always in a mitigated or modified form, in consequence of the intimate relation of these suburban districts with the city. It is impossible that it should be otherwise when we consider the wonderful facilities now afforded for rapid and frequent transportation from one point to another within a radius of one hundred miles of the metropolis. Now, if a quarantine is impracticable in a country district, surely the police-like functions of the sanitary inspecting officer ought not only to be tolerated, but be required and demanded in abundant measure, and be as liberally sustained by a generous pecuniary support and a favorable public opinion.

The mortality of Greenburg during the twelve months ending December 1, 1869, has been about two to every one hundred of the permanent residents, estimating the number of the permanent population at eight thousand. As nearly as I am able to learn there have been one hundred and sixty deaths in the district during the year ending December 1, 1869. One-fourth of this number (possibly more) have been children of various ages. Thirty, with a small allowance for error, have been aged people from fifty to sixty years old and upward. There have been eight deaths by phthisis pulmonalis among the permanent residents of this township, of which number four were adult males, and one juvenile, one adult female, and two juvenile. A few sojourners have died here during the year of the same malady. The above, I think, shows pretty nearly the real rate of mortality among the people who commonly bury their dead in the local cemeteries and hence are local residents. The rate of exchanges for burial between Greenburg and other places is pretty nearly equal.

The epidemic visitations of the past year have been scarlet fever, and an influenza or catarrhal fever. These disorders assumed generally a simple and benign form, and but few deaths resulted from them. There have been a few cases of typhoid fever, amounting in all to about twelve. Many other diseases, in certain localities, have exhibited typhoid conditions as the more prominent features of their latter stages.

There have been two cases of varioloid in the district, one resulting fatally, and one in recovery. Of the choleraic diseases nothing need be said concerning their fatality, as but few of our deaths resulted from these forms of disorder. No cholera whatever visited the district. Without being able to demonstrate the fact by figures that shall be exactly true, and hence critically reliable, I nevertheless believe, upon evidence, that fully sixty per cent. of the fatal sickness in this district among the permanent residents during the year ending December 1, 1869, was contracted in either malarial or uncleanly neighborhoods. I also as fully believe that, could we summarily banish the malarial and unwholesome sections from the district, our rate of mortality would be reduced at least thirty per cent. Believing that this banishment could really and readily be effected, I consider that our apathy in sanitary matters has made us individually and collectively responsible for at least thirty per cent. of the mortality roll of the district during the past year.

A review of your Inspector's labors during the year ending December 1, 1869, exhibits the following facts:

Total number of special inspections	210
" " of nuisances actually abated, without referring the complaints to the Board	196
" " of " abated by formal appeal to the Metropolitan Board	5
" " of " actually abated by official action	201
" " of written complaints received	13

Total number of complaints made, which were found to be either trivial or false.......	9
" " of cases of contagious diseases examined officially......................	1
" " of persons vaccinated with virus dispensed by the Board..............	120

The policy of the Board of Health, which hitherto has been to *wait for the towns* to make known their wants, has either never been appreciated or never comprehended, else the specific and positive elements of opposition to the operations of the Board, and the obstructions placed in the way of obtaining remuneration for local sanitary labors, would long ago have been indignantly frowned upon, and removed by an intelligent and generous public.

It is now evident to the Board, and not doubted by a majority of the sensible, thinking people of this community, that an aggressive and inquisitive policy is required, and will be acceptable among the people. "The worst sources of preventable disease and mortality are continually overlooked by local and inexpert town authorities; but, when faithfully pointed out by the Sanitary Inspector, the Board's instructions and orders are seldom disregarded. The people will now appreciate comprehensive measures for sanitary improvement. Though there might be some advantages in a strictly local administration, there are vastly greater advantages in a *central* organization that will always decide questions upon their merits, and with all the skill that the central system can furnish."

The sanitary district now represented by the township of Greenburg, and which once did, and will soon again, embrace Mount Pleasant, is a district of peculiar importance; not so much for reasons of an inherent origin, as for those which spring from its intimate suburban relation to the largest city and greatest seaport of the continent.

This district has been under the observation of the Metropolitan Health Commissioners, through their regularly-appointed Sanitary Inspector, from the spring of 1866 to the present time, with no greater interruption in the term of continuous official duty than was necessary to effect a reorganization of the local, or rural branch of the sanitary service. In Greenburg the services of the medical gentlemen originally appointed were retained. This localized centre of influence, emanating from the greater centre of influence and authority in matters pertaining to the public health, in and around the metropolis, became at once an actual, though not fully realized or recognized, substitute for all official operations of a sanitary nature, commonly prescribed by the town authorities. The recognition of this fact has been delayed through adverse influences of a political and partisan nature rather than through any sense of the superfluousness of such a power, or of the unsuitableness of the method adopted for maintaining and expressing the same. The Metropolitan Board is in possession of at least two documents expressive of the desire that its influence and authority should be practically felt in Greenburg, and each of these documents is signed by many citizens of the cultivated, wealthy, and largest tax-paying class. The Board has also two documents praying for relief from these influences and operations, on the ground of their uselessness and expense, and these appear over the signatures of the official authorities of the township, and of three or four resident physicians, whose opposition is no greater toward the local Inspector than toward the Metropolitan Board itself, being based upon motives strictly partisan and political. Any denial of this assertion, as evidence against its absolute verity, will fall to the ground in the light of the abundant corroborative evidence everywhere to be found. When these embarrassments to the full power and enterprise of the Metropolitan Board shall no longer exist, then will be exhibited the same active interest and ceaseless determination to effect sound sanitary conditions in the country districts that are witnessed in the cities of New York and Brooklyn.

The Board has all the plans and appliances for active operations, and only needs local coöperation. A spirit of grateful submission must prevail in order to secure the blessings of a rational, well-directed guidance, and, if need be, of a wholesome restraint in all matters looking toward the perfection of public and private hygiene. The laws of health must not only be proclaimed, and correctly interpreted by competent, trained authority, but must be vigorously and impartially enforced, not less for private and personal, than for public and general welfare. All good citizens should feel it to their honor to yield, not passively, but actively and generously, to every effort put forth for the attainment of these great objects.

Early in the history of the sanitary service in this district, when the first systematic work was being done, and the time had not been quite sufficient to enable the dissatisfied to organize any considerable and palpable opposition to the action of the Metropolitan Board, very much of essential practical work was accomplished. No thought of failure, or even of embarrassment, in the matter of raising money by town appropriations for the payment of the salary of the local officer, and other expenses of the sanitary service, had for a moment occurred to the Board, *most certainly not to the resident* Inspector.

Not far from fifty weekly and semi-weekly reports were sent from this district to the Sanitary Superintendent during the summer of 1866, giving detailed accounts of all nuisances found and abated, and of facts of a sanitary nature which the Board was entitled to know. *Not all* the facts, by any means, as the work had been too recently begun, and the means of acquiring sanitary and vital statistics were, as yet, too imperfectly elaborated. The excellent system inaugurated at that time could not, of course, be preserved after it had been discovered that the Board had been serving the public in this district under the district's official protest. I say *official*, in order to define the precise complexion of the resistance manifested to the jurisdiction of the Metropolitan Board, inasmuch as the *people* neither could nor would share in the protest. Though the work could not be so methodically performed, in the absence of local encouragement and a pledged pecuniary consideration, it was not abandoned. The people continued to make their complaints of nuisances, and of places deemed dangerous to life and health, just as they had been invited to do when the sanitary field was first occupied by the Metropolitan forces in 1866, and with results (to them) quite as satisfactory as at first. The consolidated report of services performed during the summer of 1866 in this district, then composed of Greenburg and Mount Pleasant, shows the results of systematic sanitary labor.

The items of special interest concerning this labor, briefly stated, are as follows:

Average distance travelled each day, in the line of official duty, about twelve miles.

The entire district traversed once a month. Measures adopted to be kept informed of any thing needing official attention in distant parts of the district, at times when not under official observation. This sanitary district was the only one in Westchester County, or indeed of all the rural districts, which had been free from infectious diseases during the summer of 1866, and this fact is believed to be owing to the success of extraordinary sanitary vigilance on the part of the Metropolitan Board and its own appointed agencies for the preservation of the public health.

Separate premises carefully inspected, and individuals or families appropriately counselled on hygienic subjects	1,105
Streets needing cleansing, grading, or draining, or all of these improvements	22
Drains and gutters found defective, choked, uncovered, or terminating improperly	75
Drains needed upon premises not so supplied	20
Cesspools filled, uncovered, or otherwise imperfect	5
Cesspools needed upon premises not supplied	820
Privies needing cleansing, emptying, repairing, or removing	86
Stables, cattle-yards, and sheds, unclean and offensive	58
Hog-pens, dirty, undrained, unfloored, and highly offensive	81
Garbage and decaying rubbish heaps	20
Manure heaps (some being the accumulation of two or three years)	16
Slaughter-houses kept in an uncleanly condition	6
Dead animals abandoned unburied	10
Buildings and separate apartments, including cellars—dirty, wet, or badly ventilated	63
Schools and other public institutions inspected	5
Bone-boiling establishments, and other industries of an offensive character	8
Quagmires, mud-holes, cisterns, wells, etc., inspected, and dwellings rendered offensive by the keeping of live stock, complained of	43
Personal nuisances, stagnant water, quarries, stairways, platforms, etc., in conditions dangerous to life or health	20
Submerged lots, excavations, and miscellaneous nuisances	124

As no nuisances were inspected that were not invariably reinspected at first within a fortnight, and afterward within ten days, this plan always doubled and trebled the amount of work performed, as represented by the foregoing figures, and, when abatement was ordered by the Board, the work was, in certain cases, even more than quadrupled.

Disturbances in the regularity and precision of the Inspector's work were not for causes already given, as fully developed in 1867, as in 1868 and 1869; hence the record of 1867 bears a respectable likeness and relation to that of 1866. The difference in the thoroughness and value of the sanitary service between the years that preceded 1866, and the later years, is simply the difference between the action of a few individuals, here and there, who chose to make their own inspections and complaints, on grounds more or less just and reasonable according to their own individual measure of intelligence, prejudice, and temper, and the action, on the other hand, of a duly-qualified sanitary officer who goes without invitation to all places, sees all the ill conditions of a place or a neighborhood, not as personal or private offences, but as factors of greater or less importance in their influence upon the health and well-being of the community.

It surely cannot be difficult for any thinking person to decide between the relative worth and effectiveness of the two systems, and the thinking people of this district may have their choice of either, if they will but make their choice known in terms that will indorse and ratify the operations of the Metropolitan Board of Health, and silence forever the senseless opposition of all economists and local malcontents.

The greatest good of man is the healthy fulfilment of the functions of his nature, harmonized with the conditions of his place and destiny. Can there indeed be any other good for man besides this? The study of means and methods of securing this end, and of establishing the general fruition of it among mankind; the study of the obstacles that prevent its common realization, and of the ways of removing them; in a word, the study of the causes, conditions, and treatment of human health and disease, bodily and mental, private and social, is the highest possible branch of scientific investigation. Therefore, let it be our part and mission so to study, and so to aid the study of our common happiness and welfare, that we shall never have cause to lament having done, or having left undone that which, in its essence, might even be regarded as an interference and obstacle to the complete and perfect accomplishment of the great mission of our lives.

Respectfully submitted:

GEORGE BAYLES, M. D.,

Assistant-Sanitary Inspector.

SMALL-POX AND VACCINATION.

During the twelve months ending October 3, 1869, there were 107 deaths by small-pox in New York, and 10 in Brooklyn. The mortality from this malady in New York is classified as follows:

Table, *showing the mortality from Small-pox, and the number of cases treated in the Small-pox Hospital and in City dwellings, for the year ending October 3, 1869.*

Deaths in City dwellings.	Deaths in Hospital.	Total Deaths.	No. of cases reported in City dwellings.	Total No. admitted to Small-pox Hospital from Castle Garden and Ward's Island Refuge.	Admitted from other sources.	Deaths of Children under five years of age.
67	40	107	593	303	236	60

This record shows conclusively that the loathsome contagion of small-pox has not only been threatening in the harbor, but has also been present and troublesome within the city. There died in hospital and in dwellings, 107 persons, and, of these, 60 were children under five years of age. The sources whence the Small-pox Hospital on Blackwell's Island receives its patients are various, for, excepting a special ward at the Kings County Almshouse Hospital, it is the only institution in which this disease is treated within the Metropolitan District; and, not only are the sick from shipboard sent to its wards, but all emigrants that come under the care and direction of the Commissioners of Emigration at Castle Garden. The subjoined statistics of that hospital for the twelve months ending September 30, 1869, should be examined here.

DATE.	Received from Quarantine.		Received per order Commissioners of Emigration.		Received from other sources.		Totals.		Deaths.	
October, 1868.....	1		1		4		6		1	
November, "	0		0		7		7		0	
December, "	4		0		4		8		1	
	—	5	—	1	—	15	—	21	—	2
January, 1869.....	5		2		6		13		1	
February, "	5		2		14		21		3	
March, "	0		1		34		35		4	
	—	10	—	5	—	54	—	69	—	8
April, "	2		1		25		28		1	
May, "	83		13		47		143		9	
June, "	74		22		35		131		7	
	—	159	—	36	—	107	—	302	—	17
July, "	58		10		26		94		7	
August, "	3		7		18		28		8	
September, "	1		8		16		25		3	
	—	62	—	25	—	60	—	147	—	18
Totals..........		236		67		236		539		45

The foregoing abstract requires no other explanation than this, viz., that, under the laws relating to Quarantine, all persons arriving in the harbor of New York with small-pox must be sent to the small-pox hospital at Blackwell's Island; also that the Commissioners of Charities, who have charge of that hospital, receive all cases of this disease sent thither by the Board of Health, or by the Commissioners of Emigration.

The statistics of small-pox which has occurred in the city and been brought under the immediate cognizance and official direction of the Board of Health in the past year, are as follows:

TABLE, *showing the number of Deaths from Small-pox in the Hospital, and the number in Dwelling-houses, the number of Cases reported, and the number of Dwelling-houses in which Small-pox occurred, by Quarters, for the year ending September* 30, 1869.

SMALL-POX.	Quarter ending January 2, 1868.	Quarter ending April 3, 1869.	Quarter ending July 3, 1869.	Quarter ending October 3, 1869.	TOTAL.
Number of Deaths in Hospital	2	8	13	17	40
Number of Deaths in Dwelling-houses	9	9	32	17	67
Whole number of Deaths	11	17	45	34	107
Number of Cases	39	82	307	165	593
Number of Dwelling-houses in which Small-pox occurred	31	52	216	126	425*

Most of the 593 cases of this malady occurred in crowded tenement-houses, where an average of ten or more families, and of forty or more persons, reside; yet the average number of cases in each of the houses in which the contagion was discovered was only 1.35. Our records show that there were 319 houses in which only *a single case* occurred; 50 in which *two* only; 19 in which *three*, and 22 in which *four* or more cases occurred. Cases were found in 168 streets in the city. Besides these 593 cases that were discovered, and, for the most part were reported to the Board by medical attendants as the law requires, there probably were a number of mild cases of varioloid that did not become known to the sanitary officers. With exceptions, such cases are believed to have been exceedingly light in character, and unattended by physicians; but we now have evidence that in a few instances of this kind, with ignorant or reckless exposure, centres for the diffusion of contagion were established. In 150,000 domiciles of the humble classes in the metropolis, this result seems to have been inevitable. Indeed, had not the incorporated dispensaries brought many cases to our attention among the extremely poor, no knowledge of them, in numerous instances, would have reached us until the death-record would have discovered them.

Until October, 1868, there had been scarcely a hundred cases of small-pox reported (living) to the Board of Health in the two and a half years succeeding the general sweep of the contagion in 1864–'65. The following record shows the number and result of cases of small-pox entered upon our books weekly, in the year ending October 1, 1869.

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* The number of houses in which small-pox actually occurred, during the year for which the above tabulation is made, was 410; the discrepancy is explained by the fact that the disease occurred in the same house in different quarters of the year.

SMALL-POX.	1868.												1869.																
	OCTOBER.				NOVEMBER.				DECEMBER.				JANUARY.					FEBRUARY.				MARCH.				APRIL.			
Week ending....... ...	10	17	24	31	7	14	21	28	5	12	19	26	2	9	16	23	30	6	13	20	27	6	13	20	27	3	10	17	24
Number of Cases...........	2	2	4	..	..	..	..	1	2	4	5	11	8	3	..	..	8	6	5	9	7	7	13	5	4	15	5	9	6
Deaths in Hospital.........	..	1	..	..	..	..	..	..	..	1	..	..	..	1	..	..	..	..	2	..	1	..	..	1	1	2	..	1	..
Deaths in City dwellings...	..	1	1	..	..	..	1	..	1	1	2	1	1	..	1	1	3	2	..	..	..	1	..	1	..	..	1	1	1
Total Deaths...........	..	2	1	..	..	..	1	..	1	2	2	1	1	1	1	1	3	2	2	..	1	1	..	2	1	2	1	2	1

SMALL-POX.	1869.																						TOTAL.
	MAY.					JUNE.				JULY.					AUGUST.				SEPTEMBER.				OCT.	
Week ending......................	1	8	15	22	29	5	12	19	26	3	10	17	24	31	7	14	21	28	4	11	18	25	2	
Number of Cases......................	7	15	13	35	46	27	48	34	34	28	15	23	20	12	8	6	8	5	6	5	28	24	5	593
Deaths in Hospital.....................	..	1	..	2	1	2	4	1	1	..	3	..	1	4	1	2	2	..	1	..	1	2	..	40
Deaths in City dwellings..............	..	1	2	2	5	2	3	5	6	3	1	1	1	3	2	..	..	..	2	..	..	6	1	67
Total Deaths......................	..	2	2	4	6	4	7	6	7	3	4	1	2	7	3	2	2	..	3	..	1	8	1	107

NOTE.—In the week ending May 22, one death from Scarlatina was returned from Small-pox Hospital; in the week ending May 26, one death was certified as Erysipelas, followed by Pyæmia; in the week ending August 21, one death from Measles, complicated with Hydrocephalus, was certified from Small-pox Hospital—making the total deaths in this Institution, as certified to the Bureau of Vital Statistics during the twelve months, 43. The 40 deaths in the above table were certified as Small-pox, and they occurred in a total of 539 cases.

Small-pox in Quarter ending December 31, 1869.

SMALL-POX.	OCTOBER.				NOVEMBER.				DECEMBER.					TOTAL.
Week ending............	9	16	23	30	6	13	20	27	4	11	18	25	31	
Total Cases....................	6	6	15	9	23	36	34	43	56	101	77	86	101	593
Deaths in Hospital...........	..	..	..	..	..	3	..	..	1	..	2	..	2	8
Deaths in Dwellings..........	..	..	1	1	4	2	11	13	9	17	18	11	14	101
Total Deaths.............	..	..	1	1	4	5	11	13	10	17	20	11	16	109

Seeing the evidence of increase in the contagion, the attention of the Board was called to this fact, and to the duty of inciting general interest in vaccination, in December, 1868, and again early in February, six weeks later. The Board ordered a public announcement of its advice to all classes to attend forthwith to the duty of vaccination. This bulletin was posted throughout both cities, and gave the list of places and hours in which gratuitous vaccination would be offered. But the classes and individuals that most required protection from small-pox were not generally reached by this kind of information and advice. It soon became apparent that house-to-house inspections, and the gratuitous application of vaccine virus, must be resorted to. Though early in April it was hoped that the contagion was effectually restrained, the fact was apparent before the middle of May that nothing short of a rapid canvassing of the entire city by medical officers, to advise and to vaccinate, would suffice to meet the spreading of the disease. The records of the small-pox hospital for May show what were the several sources of peril; 83 emigrants were sent from the ships at Quarantine with small-pox, 13 others were sent through Castle Garden Emigrants' Depot from the city, or from Ward's Island, and 47 other patients were sent by the Board of Health from the city, making a total of 143 patients admitted to that hospital in the month of May.

From the beginning of February, and until new measures became necessary, every house and group of houses, in which the disease appeared, was inspected, and all the persons that were found unprotected against small-pox were vaccinated by the Sanitary Inspectors; and the observations then made went to prove that from 5 to 12 per centum of the inhabitants in particular localities were at that time unvaccinated. When, in May, the presence of the contagion was found lurking in nearly one hundred different places in the city, and the most favorable season for general vaccination had arrived, the Board unhesitatingly adopted the necessary means for offering this boon from house to house. After two weeks of preparatory measures relating to the stock of virus and the distribution of labor had elapsed, sixty assistant-sanitary inspectors were added to the corps of medical officers, and the entire force, numbering eighty physicians, proceeded to the task of house-to-house vaccination.

During the two or three weeks preceding the beginning of the general vaccination, several inspectors were daily employed in vaccinating the families in the tenements and contiguous dwellings wherever small-pox appeared. But the rapid and stealthy spread of the contagion proved that this effort alone would not arrest its progress. The more general effort began none too soon, and it was fortunate that at the 1st of June an adequate supply of virus was at our command. It was also the fortune of the Board to find that any required number of accomplished physicians were ready to enter upon this task. Yet it was deemed impossible to make this systematic work quite complete from house to house, in every section of the city, before the beginning of July. It was expected that a larger class of private residences would necessarily, and with good reason, be omitted, after public interest in the duty of vaccination had been suitably awakened. More, however, was actually accomplished than had been anticipated, and, at the beginning of July, there remained only a small portion of the entire mass of the poorer classes, to whom vaccination had not been gratuitously offered in their own tenements. The eastern margin of the city from Broome to 20th Streets was less completely vaccinated than other tenement districts, and this was mainly for reasons peculiar to the population and its unparalleled overcrowding.

As the experience acquired in this work may be practically useful to the sanitary authorities of other cities and towns, we give the following brief outline of the plan:

(1.) The stock of fresh and effective virus was provided for by the aid of the several Dispensaries, their vaccine physicians having been invited to join in the effort to start and maintain a stock of virus that should possess the most perfect attributes, to be secured by means of strict observance of the rules that Dr. Jenner gave for this purpose. With this object in view, the Dispensary physicians generally joined in our councils on the subject, and, when the house to-house labors began, they maintained a daily stock of fresh and superior vaccine lymph, taken upon quills in the common way; and these charged quills or slips were scrupulously inspected, as well as many of the forming or full vesicles, by Dr. E. H. Janes, the Sanitary Inspector, whom we had assigned to this duty. Any charge or point of vaccine that exhibited a stain or any degree of opacity was cast aside as unfit for use. The report by Dr. Janes, for the corps of Inspectors, as submitted herewith, sufficiently explains the methods of the daily inspection and distribution of virus. Perfect vesicles, an absolutely fresh condition of all charges of the lymph when applied (never more than forty-eight hours from the vesicle), cool and dry packing of the virus in store (on quill-points, packed on dry cotton floss, in tight bottles, and kept at a temperature of about 40° Fahrenheit), and the employment of clean new lancets, the avoidance of the use of vaccine crusts, and the careful advice of the Inspectors while recommending and performing vaccination, constituted the essential means of success that attended this effort to give vaccination in a perfect manner.*

* The subjoined card of instructions to the corps of vaccinators gives the leading suggestions which those officers presented to families:

"METROPOLITAN BOARD OF HEALTH, MAY 31, 1869.

"*Rules Observed in Offering Free Vaccination.*—Let every family know that the Metropolitan Board of Health offers to Vaccinate every person in the City of New York who needs Vaccination; and that all who cannot, or will not, go to their family Physician or to the Dispensary, should accept this free Vaccination.

No confusion or embarrassment attended this work of vaccination, so far as concerned the organization and methods employed. There were nineteen Inspection Districts, and each of the permanent District Inspectors was made responsible for the work in his district; and, as he and each assistant were furnished with a district map, with street and block diagrams, with each physician's line of labor defined, it was easy for them to keep pressing onward until every house and block was canvassed and the task completed. But to visit every tenement in the metropolis, and offer free vaccination and the advice which the Board's officers conveyed, required great patience and physical endurance—far greater than the rate of pecuniary compensation would reward. Nearly one hundred and seven thousand families, and thirty thousand houses, were visited by these officers, and not much less than half a million of the inhabitants of the city were in this manner brought under some sort of personal inspection or inquiry with reference to the evidence of, or necessity for, vaccination. Upward of thirty thousand persons were vaccinated by these officers, and of those vaccinations they preserved records of more than 29,000. This task was performed in four weeks, by eighty Inspectors, twenty of whom were able to give less than half their time to this house-to-house labor, owing to the pressure of the ordinary duties of the Board. About two thousand one hundred and seventy-six days of labor were devoted to vaccinating in families and school-rooms, and the average number of families visited by each Inspector daily was a little more than sixty-eight. Nearly thirty thousand houses were thus visited, of which nearly twenty thousand were tenement-houses, and the dwellings of the poorest classes.

These results, and a reference to the methods, are given to show how practicable it is to make rapid and effectual work in house-to-house vaccination in a great city, when adequate means are at hand for procuring and distributing daily a fresh and ample stock of vaccine lymph. It may be remarked here also that in this, and all similar labor, in which sanitary officers have to make systematic progress, or records in any undertaking, in the dwellings and blocks of a city, the use of district and block maps is an indispensable means of preventing

"Let nothing be said to intimidate or coerce those who hesitate to receive Vaccination; but, state to all who need to be urged, that Small-pox is prevalent in the city, and among the crowds of immigrants now arriving, and that all persons should be protected by Vaccination.

"In tenement-houses, and among all classes of the poor or ignorant, let there be no failure in this work of Vaccination.

"Revaccinate in all cases where you deem it desirable.

"In private dwellings, secure the thorough Vaccination of every servant. Urge the other members of the household to be Vaccinated, and, wherever opportunity offers, explain the duty and efficacy of Vaccination.

"If you discover a case of Small-pox not already reported to the Board of Health (a list of all cases known in each district being given daily), telegraph to the Sanitary Superintendent from the nearest police-station; and, if the case is attended by a physician, confer with him immediately, and have him arrange for the proper quarantine and disinfection. The Superintendent will immediately provide for this duty, unless properly attended to by the physician and family.

"*Vaccine Virus.*—The Local Sanitary Officer, in each of the nineteen districts respectively, is charged with the duty of furnishing a supply of fresh virus during the forenoon of each day, at an hour and place to be agreed upon in each district.

"No other virus except that inspected and approved at the Sanitary Superintendent's Office, and by the District Sanitary Officer, is allowed to be used.

"Name, age, and residence of each person Vaccinated, and name of each family to whom Vaccination was offered, whether the offer was accepted or not, must be recorded, together with the date.

"E. HARRIS, *Sanitary Superintendent.*"

confusion and incompleteness in the work. This fact was illustrated in the commencement of the general vaccination, when the Inspectors were directed to begin their task at the last foci of contagion, then one hundred in number, and work outward to the completion of their respective districts.

SOURCES OF DEFECT IN THE WORK.

The chief defects in this work consisted in: (1.) The Inspectors' acceptance of promises from parents, and others, to immediately call in the family physician to vaccinate, or to take the unvaccinated to the Dispensary; (2.) the ignorant refusal of some parents to permit vaccination in their families; (3.) absence from home, or absence from school, when vaccination was offered; and (4.) the occasional failure of the operation, while urgency to canvass the whole district forbade the reinspection necessary to prevent this class of failures.

Private families were visited and advised at the beginning of the canvassing, until perhaps five thousand private residences had received such visits. But as soon as the intelligent classes had become sufficiently aroused to the duty of vaccination, this class of the population received no further attention, except when in the immediate foci of contagion. The zeal of the family physicians had to be trusted to complete whatever more vaccinating was required in private residences.

CONDITIONS OF SUCCESS IN PUBLIC VACCINATING.

Quality of Lymph.—The care exercised in taking and preserving vaccine virus was justly regarded by the medical officers as the highest of all duties in this public vaccination. The method by which the highest quality of lymph was secured will be found described in the annexed report by Dr. Janes, the Inspector of vaccine virus. The stock of lymph had been under careful repropagation, with reference to the perfecting of its quality, from February, until this vast demand was made for a daily supply. Early in March, the Dispensaries undertook in concert to cultivate their stock of lymph with great care, and at the end of May there was a large number of perfect vesicles maturing daily from which to select the charges of lymph required. Arm-to-arm vaccination was, of course, impracticable in this public work, but the highest degree of purity and freshness, of whatever virus was used, was secured by the methods mentioned in Dr. Janes' report. Much might be profitably said regarding the means by which the highest protective attributes or quality of vaccine and lymph, or stock for repropagation of vaccine, can be secured, but all this was so wisely studied and well stated by Dr. Jenner that no other teachings than his need ever be mentioned on this subject.* His rules in regard to selection and freshness of vaccine lymph have been strictly adhered to by the medical officers of the Board in this work.

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* At a time like the present, when the protecting power of the kine pock is doubted and disputed by many persons who are unfamiliar with the history as well as the art of Vaccination, the fact should be known that, as proved by Dr. Jenner himself, neglect of a few essential rules in repropagation, selection and keeping of the vaccine lymph, leads to inevitable depreciation and loss of the normal and perfectly protective attributes of vaccinia. This subject, more than any other connected with the science and practice of Vaccination, and with the permanent usefulness of the discovery, occupied the thoughts and studies of Dr. Jenner during the last twenty years of his life. And now, in later years, experience is continually showing how important those studies were, for, as has been said by Mr. Simon, Chief Medical Officer in England, so may it be said in the United States—"Millions of vaccinations have been made with lymph not possessing its original endowments." In a subsequent section of this report, we shall again advert to this fact.

It is worthy of remark that the unusual coolness of the weather throughout the month of June was favorable to the success of vaccination and the avoidance of accidents from local irritation, and whatever unhealthful conditions are incident to hot weather. It was the opinion of the inspectors, as stated by Dr. Janes in his report, that "The proportion of cases in which unpleasant symptoms followed the operation was less than the usual average in private practice," also that the very few instances of local inflammation which chanced to follow the insertion of the vaccine lymph would have been fully as numerous and severe from any similar wounds, irrespective of vaccine virus.

VACCINATION IN THE PUBLIC SCHOOLS.

As in the two preceding years, the Board of Education was consulted with reference to effective methods of securing the vaccination of all pupils and teachers. The School Commissioners approved and sustained the plan that was adopted by the sanitary officers, namely, to inspect the arms and records of the pupils and to make a determined effort to secure authentic registration of the fact of vaccination against the name of every pupil and teacher entered in the school registers.[*] With a view to efficiency and harmony in the work to be performed in schools, Dr. F. A. Burrall was detailed to the duty of arranging with the trustees and schools for vaccination of pupils.

Dr. R. J. O'Sullivan, a public-spirited school officer, also successfully undertook the task of securing general compliance with the by-law regarding vaccination in the schools of the 10th, 11th, and 17th Wards.

Some objections to vaccination, on the part of a few school-masters, were occasionally met with, but, with these few exceptions, the school officers acted a noble part, and did much to prevent popular opposition to vaccination. The report of Dr. F. A. Burrall, which, with the report by Dr. Janes, is herewith submitted, correctly sets forth the facts on this subject, and shows in what manner the thorough vaccination of the pupils was secured.

There was another branch of work in schools, and assemblages of children, which we assigned to Wm. C. Roberts, M. D. This comprised a certain class of charity schools, and asylums that were situated a little out of the course of district vaccinations. The Juvenile Asylum near High Bridge gave the largest number of unvaccinated children, nearly one-third of the entire number of inmates of that excellent institution being found unvaccinated. Upward of one hundred were vaccinated there, and forty other children of the same class, at the House of Reception for this class of offenders and vagrants, in 13th street, were found unprotected, and were vaccinated by Inspector Roberts. He visited reformatory and charity schools and vaccinated 1,000 children. The neglect of vaccination in the children of charitable care, as in different classes of families, seemed to be in a reverse ratio to intelligence and culture. This fact was well exemplified in the first ragged-school which was invaded by small-pox. The inspectors found and vaccinated one hundred that up to that time had never been vaccinated, out of one hundred and fifty pupils. This was in the "Shanty" village upon the cliffs, at the southern border of Central Park; and in this instance, as well as in that of the children at the Juvenile Asylum, is found an illustration of the quantity and dangerous intermixing of unvaccinated population that serve as the material and the propagators of small-pox contagion. It is a special illustration of the oft-repeated experience of evils begot of poverty and ignorance, projecting outward to the more favored classes, and inflicting damage to the whole community.

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[*] An appropriate by-law of the Board of Education, requiring as a condition of admission to the Public Schools that every pupil and teacher shall present and have recorded in the school register the evidence of their vaccination, had for years existed, but was practically inoperative, except in a few of the schools. The sanitary officers, in their visits to the schools during the month of June, urged and generally secured the observance of this by-law; and, wherever the District Trustees coöperated, they secured the immediate vaccination of all unprotected pupils.

The by-law above referred to reads as follows:

"VACCINATION.

"SECTION 42. No pupil shall be allowed to attend any school, nor shall any teacher be employed in the same, unless such pupil or teacher has been vaccinated. Every principal of a school shall require satisfactory evidence of such vaccination as a requisite of the admission, employment, or continuance of a pupil or teacher, and the principal shall also enter, in the register of the school, the dates, as near as possible, of the respective vaccinations of the pupils and teachers."

In whatever light the ravages of small-pox, and the protecting power of vaccination respectively, are viewed, there can be no sanitary duty more plain, and no obligation to society more positive, than that of giving to every individual the benefit of perfect vaccination. Considering the universal and deadly diffusion of the small-pox contagion, and the protecting and yet harmless effect of vaccination, to claim the privilege to deny a child this protection is to claim the right of (omissional) infanticide, while to restrain and deny vaccination to any class, or even to neglect it in individuals, or in communities, is practically to encourage, and to do homicide, by disregarding the voice of reason and experience.

This view of the duty of vaccination makes it desirable to present in this report the leading facts upon the sanitary aspects of Dr. Jenner's great discovery. We first present the following abstract showing the quantity and distribution of this disease in New York during the past twelve months:

Analysis of the Small-pox Record for the year ending September 30, 1869.

Total number of streets in which small-pox occurred.........	168
" " houses " " "	410
" " cases " " "	*588
Number of houses in which only 1 case occurred...........	319
" " " " 2 cases "	50
" " " " 3 " "	19
" " " " 4 " "	11
" " " 5 or more "	11
" " more than 1 and less than 5 cases occurred...	80
Greatest number in any one house........................	8
Number of streets in which only 1 case occurred............	75
more than 1 and less than 10 occurred..	77
" 10 " 20 " ..	14

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* This number must be increased by 5 to account for cases that could not be charged to any house in the city, but were found floating about, homeless and sick, thus making the actual total of cases 593.

Number of streets by name in which more than 20 occurred:

Pitt Street cases	20
West 16th Street cases	30

The history of these 593 cases of small-pox in 168 streets of the metropolis, and distributed in no less than 410 different houses, has been particularly instructive in regard to the following points respecting the practical application of vaccination as a sanitary measure:

(1.) The contagion of small-pox obeys certain laws that ally it to the epidemic kinds of disease;

(2.) There is no reason to expect that this pestilence will ever be kept suppressed except by the agency of vaccination;

(3.) That the doctrines and rules which Dr. Jenner taught, concerning the perfect operation and repropagation of vaccinia as a prophylactic, are culpably neglected, and often forgotten.

1. EPIDEMIC SMALL-POX.

The acknowledged and obvious dependence of variola upon a specific contagion, and the concentration of the intensest quality of this poison or virus in the pustules that constitute the outward sign of the malady, have led many to believe that whatever epidemic phenomena may at times characterize it, are strictly the results of contagion. Yet no one would presume to classify small-pox with the contagion of syphilis, for the latter seems to operate exclusively by inoculation, or, at least, by absolute contact, and that contagion is, moreover, not a fever, but an enthetic poison, while small-pox is a specific fever and obeys laws that ally it with the pestilences which spread as epidemics.

Yet, as an epidemic and as a pestilence, it may be proved, as we at present believe, that this disease, like cholera, typhus, and several other pestilences, becomes epidemic by means of its contagion, or, as M. Gendron has said, "*l'epidémie est l'effet, et non la cause de la contagion.*" Whatever external and general conditions in nature may exist at different intervals, favoring the unusual prevalence of this loathsome disease, the chief fact to be noticed is, that, except when prevented by vaccination, there are two well-understood circumstances which not only favor, but insure the epidemic prevalence of small-pox, namely:

(1.) The presence of a large number of persons unvaccinated, and, consequently, susceptible to the disease;

(2.) The outbreak of the contagion in numerous places in a populous community.

Certain historical facts relating to this subject should here be noticed, for they show that the frequency and fatality of small-pox epidemics depend mainly upon the coincidence of the two circumstances just mentioned; and, if these are the only essential conditions, it matters not how great the external or local and pandemic conditions may be, for the protective power of vaccination can restrain such epidemic spreading of the disease. The subjoined records indicate the law of small-pox epidemics, as well also as the degree of interference which vaccination has exercised over such epidemics.

The recent occurrence of a vast amount of small-pox (mostly in the modified form), in populations that had received a more or less imperfect vaccination in youth, the unparalleled prevalence of the variolous contagion among emigrants, and from the German and Scandinavian countries that have for sixty years and upward been distinguished for the universality, though not for carefulness and Jennerian perfectness, of vaccination, and the renewed attempts of numerous persons to discredit the utility of this discovery, should incite us to a scrutinizing examination of these statistical facts.

The following abstract shows the number of deaths from small-pox, and the total mortality in successive years, in New York, from January, 1804, to January, 1870, a period that dates back to the beginning of general vaccination.

TABLE,

Showing the Deaths by Small-pox, and the Total Mortality in the City of New York, by Years and Decades, for the 66 *years ending December* 31, 1869.

Year	1804.	1805.	1806.	1807.	1808.	1809.	Total for 6 years.
Number of Deaths from Small-pox	169	62	48	29	62	66	436
Mortality from all causes	725	..	..	..	424	..	1,149

Year	1810.	1811.	1812.	1813.	1814.	1815.	1816.	1817.	1818.	1819.	Total for 10 years.
Number of Deaths from Small-pox	4	117	21	2	2	94	179	14	19	......	452
Mortality from all causes.	......	40	2,503	2,335	1,961	2,511	3,000	2,384	3,005	3,178	20,917

Year	1820.	1821.	1822.	1823.	1824.	1825.	1826.	1827.	1828.	1829.	Total for 10 years.
Number of Deaths from Small-pox	......	......	......	18	394	40	58	149	93	16	768
Mortality from all causes.	3,522	3,422	3,212	3,551	4,224	4,920	4,961	5,139	4,818	4,501	42,270

Year	1830.	1831.	1832.	1833.	1834.	1835.	1836.	1837.	1838.	1839.	Total for 10 years.
Number of Deaths from Small-pox	176	224	89	25	233	351	173	164	91	68	1,594
Mortality from all causes.	5,522	6,347	10,257	5,689	8,907	7,096	8,068	8,626	7,911	7,910	76,333

Year	1840.	1841.	1842.	1843.	1844.	1845.	1846.	1847.	1848.	1849.	Total for 10 years.
Number of Deaths from Small-pox	232	200	181	117	21	425	141	53	544	326	2,240
Mortality from all causes.	8,469	9,093	9,154	8,659	8,890	9,652	11,411	11,273	11,280	16,972	104,853

Year	1850.	1851.	1852.	1853.	1854.	1855.	1856.	1857.	1858.	1859.	Total for 10 years.
Number of Deaths from Small-pox	231	562	497	656	611	101	388	423	492	60	4,021
Mortality from all causes.	10,332	14,029	15,490	21,979	28,437	24,448	21,748	22,811	23,269	22,745	205,288

Year	1860.	1861.	1862.	1863.	1864.	1865.	1866.	1867.	1868.	1869.	Total for 10 years.
Number of Deaths from Small-pox	274	599	268	73	382	664	26	35	24	203	2,548
Mortality from all causes.	24,760	24,525	23,150	26,617	25,792	25,767	26,815	23,159	24,889	25,167	250,641

	Total for 66 years.
Number of Deaths from Small-pox	12,059
Mortality from all causes	701,451

The total deaths from small-pox in these sixty-six years were 12,059. The total mortality by all causes was 701,451, as given in the foregoing table; or, more exactly, by filling up omissions that are known to have occurred in the public registers between 1805 and 1810, the total by all causes was 708,451 deaths. The ratio which small-pox bears to the total list is seen to have been 17.02 in 1,000 deaths.

Previous to 1801 there was no public registration of deaths; but the chronicles of New York, in the century preceding the introduction of vaccination, indicate the fact that small-pox destroyed not less than ninety out of every 1,000 that died; and that the contagion prevailed epidemically more than half the time, and during long periods, in no less than two in every three years; and that in those years it was more than twice as fatal as in the intervals of those outbreaks. That is, the relative number of deaths by small-pox in New York, in the sixty-six years previous to the introduction of vaccination, was more than five times greater in every 1,000 deaths than in the sixty-five years that have elapsed since vaccination was introduced.

In the city of London, during the ninety-one years ending A. D. 1740, small-pox prevailed as an epidemic in sixty-five of the years; and, in the sixty-three years that intervened between that date and the general introduction of vaccination, it prevailed epidemically in fifty-three years. But during the entire vaccinial period the average intervals of any unusual prevalence of small-pox have exceeded three years each.

In the one hundred and eighty years preceding the introduction of vaccination in America, small-pox is reputed to have destroyed more than one-tenth of the civilized population, and nearly, or quite, one half of the Indian tribes on this continent. Mr. Catlin, the great historian of those tribes, states that, out of twelve millions of North American Indians, no less than six millions perished by small-pox.

The introduction of *inoculation* of small-pox, as first practised at the suggestion and by the example of Lady Mary Wortley Montague, did not diminish the total mortality by the disease in any marked degree. It merely gave to individuals under special care, and long preparation, a certain degree of security of life. In comparing the small-pox mortality of the past with that of the present century, we need not mention that equivocal method of protection against epidemic small-pox, except to remark that, in consequence of the increased number of persons that have been thus protected by inoculation, each epidemic outbreak destroyed fewer lives, and caused less panic, than had been the case with the great outbreaks of the disease previous to the introduction of that dangerous practice. In England, the rate of mortality from small-pox, in the last half-century preceding the introduction of vaccination, is reported by the Epidemiological Society to have been as follows:

In the ten years ending 1760......100 in every 1,000 deaths.
" " 1770......108 " "
" " 1780...... 98 " "
" " 1790...... 87 " "
" " 1800...... 88 " "

The published records of the English Registrar-General show that, in the ten years ending in 1850, small-pox was charged with only sixteen deaths in every 1,000, by all causes. The aggregate records of mortality in all Europe, for the ten years ending in 1850, show that small-pox was charged with only seven and one-quarter deaths in every 1,000, by all causes; but, in the same countries during the thirty years immediately preceding the introduction of vaccination, the records of mortality prove that no less than sixty-six and one-half in every 1,000 died of small-pox, while in several of those countries where the application of that great discovery was most complete, as in Sweden and Moravia, small-pox caused less than three deaths per 1,000 in the total mortality. In the twenty-five years preceding vaccination in the city of Berlin, seventy-seven out of every 1,000 deaths were caused by small-pox; and in a corresponding period, ending in 1850, only five and a half out of every 1,000 deaths were charged to this malady. In particular cities and districts in which vaccination was most faithfully enforced, the contagion remained long banished, as, for example, in Copenhagen there was not a death from small-pox in thirteen years; and in the Duchy of Baden there was a similar exemption for eight years.

Imperfect and incomplete as the vaccination of the people has been in almost every country, small-pox as a raging pestilence has been kept in abeyance by it, throughout the civilized world, for sixty years; and the mortality statistics of all countries show that deaths from small-pox have fallen off from former ratios just in proportion to the thoroughness and general adoption of vaccination; and that, with all the imperfections and faults that have characterized vaccination, as ordinarily performed, and the great number of unvaccinated persons in most communities, still the average number of deaths by small-pox has been for sixty years, and yet continues to be, only about one-sixth as great as in the century that preceded the introduction of vaccination.

The facts here mentioned prove that vaccination has certainly interfered with the frequency and force of small-pox epidemics, diminishing both of them to less than one-third the rate that prevailed in the century preceding Jenner's discovery. Still the epidemic tendency of this disease is manifested at intervals, but within such limits as the imperfection or neglect of vaccination admits. This epidemic appearance of the disease has, in the twenty-five past years, been witnessed in eight of the years; and in four of these epidemics the unusual prevalence of the contagion has continued through more than a single year; and each epidemic has continued until the popular interest in vaccination increased sufficiently to induce very general attention to that duty.

In all respects small-pox seems to conform to the natural laws which govern specific contagions that have the property of becoming epidemic. The increase of small-pox to such a degree of prevalence as to make it epidemic is never sudden; and, whatever may be the favoring domestic or atmospheric conditions, the sanitary measures which are found to arrest the contagious principle of the disease completely prevent the epidemic. The epidemic phenomena of this pest are but the phenomena of contagion intensified.

2.—VACCINATION THE ONLY MEANS OF SUPPRESSING SMALL-POX.

For centuries the people of Europe endeavored to suppress this disease by quarantining all persons and things which were known to be infected with it; and, in connection with the practice of inoculation during the last century, the art of quarantining or isolation reached a degree of completeness, as well as powerlessness, that rendered all further proof of its insufficiency, as a main reliance, unquestionable. Even the best directed efforts to make the practice of inoculation universal actually led to the perpetuation of small-pox contagion, and to a continuous series of outbreaks of it in infants and others. This was an inevitable effect of the contagion, which neither cold nor moisture, nor any known lapse of time, seems to destroy.

When young Edward Jenner went down to London from Sodbury—his country home—in the year 1770, with his mind filled with the thought that against this dreadful disease it might perchance yet be possible to give all people the same kind of protection which seemed to have been given by the variolated cows to the milkmaids of Gloucestershire, by inoculating with kine-pock—which could be safely resorted to—instead of the human small-pox, and the crusts and fluid-virus of the former be openly exposed and handled without spreading disease, his longing desire that such a result might prove true was the first step to the great discovery. The inspiring hope of attaining a permanent triumph over this most dreaded and fatal disease was encouraged by the words of Jenner's preceptor, the renowned John Hunter.

The exclamations of vexed incredulity and disdain by various learned persons could not hinder investigations and experiments that were prompted by this desire and possibility for the achievement of a conquest over a loathesome contagion, which for centuries had been destroying one-tenth of each successive generation of the human family, and which no art could arrest. Hence, from the first dawning of Jenner's discovery until now, the facts relating to vaccination and the kine-pock have been studied with reference to the general suppression of small-pox, as well as the protection of individual lives.

Viewing the design and duty of vaccination from such a stand-point as the God-like mind of its discoverer viewed them, it would seem possible for all classes of people to appreciate and apply this protecting agent so faithfully and universally, that small-pox would soon be known only in the history of evils removed and dangers passed. But experience shows that three different circumstances continue to operate in our time, as they did in Jenner's, to prevent the perfect realization of these most desirable objects. These opposing circumstances are:

(1.) The incredulity of many persons regarding the safety of vaccination, and the certainty of its protecting power; and hence the neglect or refusal to be vaccinated.

(2.) The imperfect or incomplete degree of vaccination in some persons, that are not so vaccinated and revaccinated as to exhaust their individual susceptibility to the virus of vaccinia; and, consequently, to that of small-pox.

(3.) The neglect of the necessary rules for the propagation of vaccinia, and for the selection of the vaccine lymph.

These obstacles to the final and utter suppression of small-pox are not so great that they may not be overcome; but, until overcome, they will be the causes of anxiety and study by physicians and Boards of Health.

During the past year or two there has been some very fallacious writing and criticism in the newspapers respecting the failures of vaccination, and the recurrence of all the terrors of the pre-vaccinial period. Such assertions and fallacies are both stupid and pernicious. Such writing has been kept up at intervals ever since Jenner's time: yet no demonstration in the arithmetic of facts is plainer than that the rate of mortality by small-pox has, in all civilized nations, fallen off to a mere fraction of the death-rate by this malady, in the pre-vaccinial period. The habits of the contagion remain unaltered, but vaccination has taken away its power to destroy or to harm. It attacks only such persons as are unvaccinated or imperfectly vaccinated.

We speak of imperfect vaccination because in each recurring epidemic the test of the protective power of vaccinia is so brought to bear as to prove: (1.) That there is such a thing as a standard vaccinial protection, which can abide the test of all degrees of exposure to small-pox contagion; (2.) That there is, at the same time, a certain minority of vaccinated persons that cannot wholly resist the operation of the contagion. Yet the number of the vaccinated who resist the contagion, however much exposed to it, is scarcely less than ten times more numerous than the number of vaccinated persons who partially succumb to it, and suffer varioloid. It is not necessary in this place to examine the causes of imperfection of certain kinds or modes of vaccination. The rule should be—and ere long will be, both in public and private vaccinating—to revaccinate every person, until all susceptibility to the vaccine virus is removed. This is the method which physicians adopt for their own individual protection, and for the protection of nurses in small-pox hospitals, and it should be the invariable rule in every physician's practice. When applied in a great number of persons that have once been vaccinated, it demonstrates the fact that from twenty to sixty per centum of the total number of persons only once vaccinated are found wholly unsusceptible to the operation of the virus of vaccinia; or, of what is exactly tantamount, the virus of small-pox. Even the worst ravages of epidemic small-pox have never attacked as great a proportion of vaccinated persons as would, by revaccination, be proved to be susceptible to a partial operation of the contagion.

As regards the practicability of so perfecting the method and duty of the physician, and of sanitary authorities, in the performance of vaccination, that all causes of defect will be removed, there need be no doubt, nor any hesitation in putting forth endeavors to achieve this most desirable object. There are numerous practitioners in the Metropolitan District who, in their lifetime, have not had the misfortune to have a single one of the persons whom they have vaccinated and revaccinated—out of hundreds—suffer an attack from the variolous contagion; but there are other physicians who vaccinate, and who treat the whole matter of selection and conservation of lymph, alike, in the most careless and unskilful way; and whose patrons have scarcely a probable chance of being so vaccinated as to be long or fully protected against variola. Again, there are entire towns and districts, in the metropolitan counties, in which this culpable neglect of the Jennerian rules of vaccination prevails, and in which epidemic varioloid may at any time occur, as it has recently occurred in a certain quarter in the 11th and 17th Wards of New York, among the emigrant classes.

It is unnecessary in this place to adduce all the proofs that vaccination alone can keep small-pox suppressed. The fact is confessed on all sides, that the virus of small-pox is so active, subtile, and persistent, that there can be little hope of eradicating it by any kind of quarantine for the sick. Without vaccination, the entire human family, with individual exceptions only, was doomed to suffer an attack of small-pox, and one-tenth of the people were sure to die of it. The discovery of the fact that the contagion of this disease, when transmitted through and repropagated from the cow, loses all its diffusive or epidemic qualities, and retains as full power to remove the susceptibility to variola as the disease itself possesses, is the absolute truth upon which sanitary authorities and States can safely claim the right of compulsory vaccination.

3.—THE PERFECT SUCCESS OF VACCINATION AND THE COMPLETE SUPPRESSION AND EXTINCTION OF SMALL-POX DEPEND UPON A FAITHFUL ADHERENCE TO THE JENNERIAN RULES.

The *right* to enforce the vaccination of every member of the human family, or of every person in a neighborhood or city, will justly be disputed so long as the duty of vaccination is performed in a faulty or defective way. As has previously been remarked, incredulity and prejudice in regard to vaccination are the greatest obstacles to such an universal application of the benefits of this boon as would forever suppress and exterminate small-pox from the human family. Careful inquiry in regard to the true and removable causes of the prevailing objections to vaccination have long ago convinced me, as they have convinced others, that were the medical profession carefully to study and practise the principles laid down by Dr. Jenner, and by his great practical successors, Marson, Ceely, Helm, and Simon, all popular objections and opposition would soon be swept away, and, by virtue of perfect and universal vaccination, small-pox would become a rare curiosity in diseases among civilized people.

We venture in this place to recount a few items of evidence, to show precisely what results from the unskilful and slovenly kind of vaccination which many practitioners are justly charged with.

Small-pox in persons who have been vaccinated.—In the recent epidemic outbreaks of small-pox in New York, not less than two out of every three of the patients had been vaccinated, but seldom has an inspector found any such vaccinated persons exhibiting even a characteristic and good scar of the vaccine vesicle—often the scar was but a punctum, or, in certain instances, a dubious cicatrix like that of a burn—though the scar at best is not a sure index of the complete operation of vaccinia. Dr. Marson, after twenty years' experience in the London Small-pox Hospital, reports that 3,094 of his patients in that institution had previously been "vaccinated," but that out of that number only 268 presented good marks of their vaccination. Though, out of those 3,094 "vaccinated" patients, 2,149 suffered only the modified or varioloid eruption, and only 29 of this latter class died. Dr. Marson states that in many of the patients the vaccination had been performed by "bungling operators."

Mr. John Simon, Chief Medical Officer of the English Privy Council, has significantly said: "A local prejudice against vaccination would, in my judgment, be a reason for inquiring into the skill with which, in the prejudiced locality, vaccination has been administered."* And upon this subject this masterly observer remarks further: "Among the so-called prejudices against the practice, there are some which represent a partial truth; erring indeed only in so far as they impute generally to vaccination what they should have imputed exclusively to the vaccinator. Considerable disturbance of health has often followed—sometimes to a dangerous and even fatal extent—the improper acts of persons pretending to vaccinate. If all operators equally had been impressed with the necessity of following Jenner's short and simple teaching; if all equally had inquired into the state of health of children they were about to vaccinate, and had stayed proceeding till any temporary ailment had been removed; if all equally had been careful as to the condition of children from whom lymph has been taken; if all equally had been content to study the natural progress of the Jennerian vesicle, and the different qualities of material which it furnishes at successive stages, or under accidental disturbances, of its course; if, in short, all equally had recognized that vaccination is not a mere easy trick of the fingers, that it requires to be done, and that its results require to be followed, with the observant eye of an educated special experience—if, I say, the substance of this had been in the minds of all who have pretended to vaccinate, little, very little, would have been heard of prejudices against that matchless discovery."

That complete success in vaccination depends chiefly upon very nice and discriminating care in the selection and repropagation of virus (lymph) possessing perfect attributes, is well understood by all who know the history of vaccination; and that the duty of the vaccinator is but half finished even when he has skilfully inoculated an arm with such perfect vaccine lymph, is a truth which the people as well as the physician should understand; for the signs of good vaccination should be inspected when the vesicle has formed, and, whenever a doubt of its sufficiency arises, the operation should be repeated until all the individual susceptibility to the vaccinial virus is overcome. Now, all this requires the exercise of good judgment and the skill of a good medical observer. And, as regards the public or sanitary regulation of vaccination, the selection of virus and the management of all these duties demand expert and authoritative supervision, for, as Mr. Simon has remarked, "What has to be administered is not a mechanical matter of routine and registration, but a system which from beginning to end, and from centre to circumference, requires in all its parts to be vitalized by the *science of medicine*."

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* *Papers relating to the History and Practice of Vaccination*, p. lxxiv. *Blue Book*, 1857. "A local prejudice against vaccination would, in my judgment, be a reason for inquiring into the skill with which, in the prejudiced locality, vaccination has been administered; whereupon I should not be surprised to hear of some individual case in which nominal vaccination has either proved useless as a protective against small-pox, or has occasioned unexpected suffering to the child; and the inquiry, if pressed further, would probably show that the origin of this scandal has either been (on the first supposition) one of those imperfect vaccinations against which Mr. Marson protests, or (on the other supposition) some incompetence or neglect relating to the selection of lymph, or the due preparation of the patient."

Having thus set forth facts that show what necessity exists for adhering to the medical and physiological principles that govern the perfect operation of vaccinia in man, the Jennerian rules may be concisely stated as follows:

(1.) The physician must know how to distinguish perfect vaccine vesicles, at a glance.

(2.) Lymph for use as virus must be taken just when its specific attributes and efficiency are most sure and perfect, namely, at the eighth day after the operation; and from perfect and regular vesicles.

(3.) Every vaccine vesicle and all results and symptoms should be carefully examined by a medical attendant on the eighth day after the operation.

(4.) The operation of vaccination should be skilfully performed with sufficient fresh lymph. Unskilful vaccination should be prevented by the intervention of popular instruction and aid in all that relates to the means of securing perfect results; and, to this end, the local sanitary authorities should at all times be prepared to supply fresh vaccine lymph, and by expert physicians give perfect examples in vaccination as well as be instantly ready to control any outbreak of small-pox that may occur.

These conditions of success in vaccination and the suppression of small-pox are based upon rules that Jenner taught. His close study of the subject for more than thirty years resulted in the attainment of an exact knowledge of the means of perfect success in the practice of his discovery, but in no country have the Jennerian rules been strictly observed. The practice is apparently so simple and even trivial that both physicians and parents generally overlook the skilful discrimination by which absolute success is to be secured in every vaccination. But this folly and ignorance must give place to the exact and scrupulous study and application of the principles upon which complete success in the art of vaccination depends. The crusade that has, from Jenner's time until now, been spasmodically waged against small-pox, and which has often been guilty of wide departures from the true Jennerian doctrines and practice, must soon give place to the rational and methodical administration of the means for extirpating this monstrous enemy of the human family. In this effort to establish perfect methods, and give to them adequate authority, sanitary officers and Boards of Health are charged with a most important duty, for they must lead in the effort, and never desist until small-pox shall have been banished from civilized communities.

The first generation which received the benefit of Jenner's discovery has not yet all passed from among us: society has but just reached the favorable period for the needed review and organization of methods for undertaking to give entire protection against small-pox. The old story of lack of faith in its efficacy should not hinder the organization of means for making vaccination universal. Stupidly fallacious as certain prejudices against this means of protection are, let it be remembered that such prejudices would never have existed had not vaccination been unskilfully or faultily performed and the Jennerian principles neglected. The prejudices will quickly disappear when vaccination shall have been universally and skilfully applied. Until this object shall have been attained, there will continue to be more or less noisy and senseless opposition to this sanitary duty. Charlatans and ignorant men may utter their outcries and objections, but all such clatter is only "the jingling of advertising carts," and will not seriously hinder well-devised efforts of sanitary authorities in plans for general vaccination. Let the subject of vaccination be well understood by the people, and let no unskilful vaccination be practised, then will this clamor against it be silenced and universal protection against small-pox be given, as Jenner predicted, when he said: "It is too manifest to admit of controversy, that the annihilation of small-pox, the most dreadful scourge of the human species, must be the final result of the practice." *

In the recent outbreak of small-pox in New York, the Metropolitan Board of Health expressed in a practical way the confidence which the public has in vaccination as a sanitary duty. All the national governments in the civilized world likewise avow the same confidence by establishing, as they have, regulations requiring the vaccination and revaccination of every man who enlists in the army or navy.

Stumbling, and perhaps discouraged at the sight of frequent outbreaks of the variolous contagion and its epidemic prevalence as varioloid in great numbers of cases, at intervals of five or six years, some persons affect to discard the Jennerian faith, and renounce all dependence upon vaccination. But sanitary officers and Boards of Health find that, wherever they succeed in vaccinating an entire community in a proper manner, small-pox is banished and remains banished until fresh and susceptible additions to the population chance to have been made. Such additions, by birth or immigration, become food for this ravaging pestilence, which only waits the introduction and growth of the contagion to again renew its deadly work; but such events should be so investigated and controlled as to confirm the truth of Jenner's doctrine, rather than be the occasion for overturning and weakening the public faith in the duty and practice of vaccination.

In dealing with the public duty of vaccination when small-pox has gained foothold, hesitation would be criminal folly, and insufficiency or inexpertness in the application of the one protective agency of vaccination would be unpardonable. But there are many practical difficulties which so seriously interfere with the duty of universal vaccination and the "stamping out" process in dealing with small-pox in great cities and commercial towns, that, as a constant sanitary defence, it is absolutely necessary to maintain a system of house-to-house vaccination at sufficiently frequent intervals to secure the protection of every household against invasion by the contagion. The performance of such a duty can be efficiently insured only by sanitary officers and under the sanction of laws that shall adequately guard against unskilful and injurious practices, and against

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* Evidence given before the House of Commons, March 22, 1802, by Dr. Edward Jenner.

neglect and omissions in the work. In smaller cities and in particular parishes, house-to-house vaccination has been practised occasionally ever since the days of Jenner, but, in a population like that of New York, such a task was once deemed impracticable; but there came a necessity for attempting its accomplishment, and the Metropolitan Board of Health authorized the undertaking.

As the results have proved highly instructive, and may usefully be quoted, together with the facts concerning the means by which these results were attained, we herewith submit the following summaries relating to Public Vaccination.

I. The Organization, Economy, and Supervision, of Public Vaccination.

II. The Summary of Methods and Results of the House-to-House Vaccination by the Sanitary Inspectors. [Dr. E. H. Janes' report.]

III. Vaccination in the Public Schools. [Dr. F. A. Burrall's report.]

IV. Vaccination in Ragged Schools, Asylums, and Charity Schools. [Dr. Wm. C. Roberts' report.]

V. Rules observed in Public Vaccination and in the sanitary control of Small-pox.

I.

Organization.—At the end of May last, the questions respecting organized efforts to suppress small-pox were presented as follows: (1.) How to control the spreading of contagion from centres (cases) exceeding one hundred in number: (2). How to secure a daily supply of vaccine lymph fresh and pure from healthy infants that were not exposed to small-pox: (3.) How to select, distribute, and perfectly supervise the duties of a sufficient number of Sanitary Inspectors (vaccinators), who should in thirty days vaccinate from house to house in from 110,000 to 120,000 families of the poorer classes, and in the schools and other institutions of the city: (4.) How to accomplish these results with the best skill, and at the same time preserve some useful records of the work, without incurring expenditures that would discourage future endeavors to vaccinate from house to house.

The nearly 20,000 tenement-houses, averaging six or seven families to each house, were to be visited, and the work must begin at nearly eighty different centres in which cases of small-pox at the time existed. Seventy-nine physicians were selected, and with brief instructions and a map of the sub-district that was assigned to them respectively, a list and map record indicating places and dates of infected houses, and with the requisite outfit, after subscribing the usual oath of faithfulness required by the Board, they proceeded to the task. This task was not completed until they had visited nearly 30,000 houses and given needful advice in families comprising more than half a million of the population.

The provision of daily supply of fresh virus had for six weeks been anticipated by coöperation of the vaccine physicians of the Dispensaries, and as no crusts and stored virus were allowed to be used, where there was so much responsibility for possible impairment of the virus, the daily supply had to be provided for by means that could not fail.

Pecuniary Cost of the Public Vaccination.—To achieve the results desired by the Board, the Sanitary Committee selected such physicians as would patiently endeavor to make thorough work, and who would prudently discriminate in regard to what omissions to allow in their house-to-house visits and in their vaccinations.

To preserve complete records of all the vaccinations and the results of the work was not possible, under the pressure with which it was urged forward. The subjoined records show the classification and amount of some of the particulars of which the vaccinators preserved notes.

The total cost of this special work foots up as follows:*

Sixty Special Medical Inspectors (vaccinators) 1 month at $100.....	$6,000.00
Nineteen District Sanitary Inspectors (half their time)............	1,125.00
Total for medical service....................................	$7,125.00
Total amount of bills paid for vaccine virus......................	1,599.25
Bills for new vaccinating lancets, quills, slips, and apparatus........	89.60
Total expenditures..	$8,813.85

The foregoing statements present barely the facts concerning the vaccinations by the hands of the Board's special corps, in the month of June last. There was another and not less important work done at that time, and which is still continued, namely, efforts to instruct and advise families, guardians, and teachers, in regard to the duty and means of securing the vaccination of all persons. By this effort the total amount of vaccinating by private physicians and the medical dispensaries of the city is believed to have been quadrupled since April last. The records of the vaccinations in the incorporated dispensaries foot up as follows for the two successive years 1868 and 1869:

NAME OF DISPENSARY.	Total Vaccinations in 1868.	Total Vaccinations in 1869 to date (December 22).	Total Vaccinations in the 3 months ending March 31, 1869.	Total Vaccinations in the 3 months ending June 30, 1869.	Total Vaccinations in the 3 months ending Sept. 30, 1869.	Are you now vaccinating?	How many vaccinated in December?
Central Dispensary............	....	235	17	203	9	......	*
Demilt "	1,067	1,715	124	1,317	108	Yes.	100
Harlem "	48	96	30	25	....	Yes.	41
Yorkville "	1	58	....	55	3	......	†
Northeastern "	310	566	73	388	50	Yes.	25
Northwestern "	243	420	5	415	....	No.	....
Eastern "	4,314	5,326	210	4,300	360	......	456
New York "	1,353	1,779	51	1,662	41	Yes.	7
Northern "	417	1,411	210	1,201	....	......	....
N. Y. Homœopathic "	295	660	112	525	15	Yes.	5
Hoffman "	231	425	104	81	120	......	....
New York Infirmary for Women and Children............	46	69	3	48	18	No.	Not any.
Total............	8,325	12,760	939	10,320	724	......	634

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* The fact may here be stated that the actual cost for vaccination by the Board's Inspectors last summer was only about half the sum to which it would have amounted under the sanitary laws of

* Only one applied for Vaccination in December. † No applications.

II.

SPECIAL REPORT UPON VACCINATION PERFORMED BY THE SANITARY INSPECTORS, NEW YORK, IN JUNE, 1869.

The following report has been prepared, on behalf of the corps of Sanitary Inspectors, by Dr. Edward H. Janes, the officer who, as Inspector of vaccine lymph for the entire corps, as well as Sanitary Inspector in a badly-infected district, had the best opportunities for studying the subjects that are treated in this record of the work of vaccinating. Dr. Janes has carefully reviewed the records which were preserved by his associates, and which, though incompletely kept during the period when the work was most urgent, are instructive and useful. This report, with that of Dr. Burrall, which follows, gives a correct and condensed statement of the work accomplished by the vaccinating corps in the special canvass of the city in June last.

Elisha Harris, M. D., *Sanitary Superintendent.*

Sir: I have the honor to present the following report on public vaccination as inaugurated and prosecuted under the authority of the Metropolitan Board of Health during the month of June last.

The history of the introduction and propagation of small-pox in New York during the past winter, the ineffectual efforts made by the Board to arrest the spread of the disease by the isolation of patients, the disinfecting of premises, and securing the vaccination of all in the immediate vicinity of each infected house, and other circumstances preceding and introductory to this special effort, have already been the subject of a portion of the Board's Annual Report. It therefore only remains for me to present a brief history of the labors of the sanitary inspectors and their associates in this particular field, together with such matters as may be of interest in connection with the subject, the final result of these labors, and such concluding remarks and suggestions as may be derived from the experience of the physicians who were engaged in this undertaking. At a stated meeting of the Board of Health, held May 27, 1869, a resolution was adopted, empowering the Sanitary Committee and the Superintendent to select sixty physicians, who were to receive the appointment of Assistant-Sanitary Inspectors, for one month, and who were to be detailed to the special duty of assisting in the effort to secure gratuitous vaccination throughout the city to all who required and would accept of it. In accordance with this resolution the following gentlemen were appointed: Drs. J. W. Baldwin, Dwight Ruggles, E. C. Passmore, Wm. F. Thoms, E. McSweeny, H. Raphael, H. Brennan, J. W. Bowden, G. W. La Cato, B. F. Dawson, L. Dohme, B. M. Keeny, W. J.

England, for, at rates established in that country for free vaccination, $18,000 to $20,000 would have been expended in giving vaccination to 30,000 persons at vaccinating stations. The cost to this Board for each vaccination by its medical officers last summer a little exceeded 29 cents. Such economy in the money cost of vaccination was possible only with the aid of the public dispensaries, as chief sources of supply of fresh virus daily. Those medical charities lent their aid in supplying virus, and in procuring fresh stock under the advice and inspection of the Board's officers.

The English Sanitary Act of 1867 provides that the fee for each vaccination under the Poor-Law Unions and in work-houses shall be two shillings sterling when performed over one and within two miles of the vaccinator's residence, and that it shall be three shillings when the distance exceeds three miles. This is nearly double the rate paid by the Metropolitan Board of Health.

Welch, F. C. Curtis, F. J. Maynard, W. Balser, W. T. Carpenter, W. P. Worster, G. Wynkoop, W. T. Day, J. T. Kennedy, G. H. Butler, David Brekes, D. De W. Harrington, L. Le Baron Hart, W. J. Purcell, J. J. Brownlee, C. Stokes, James Ross, O. G. Smith, C. H. Ludlum, C. J. Pardee, A. B. De Luna, S. B. W. McLeod, P. F. C. Deslandes, E. L. Keyes, J. F. Morgan, J. A. Robinson, C. F. Jay, J. A. Frazer, A. Duberceau, E. H. M. Sell, H. J. Smith, C. Stokes, H. E. Jones, Wm. B. Lewis, F. C. Langdon, R. Tauszky, W. H. Van Wyck, S. W. Roof, A. A. Davis, A. P. Williams, J. E. M. Lordly, A. S. Heath, Ira B. Read, J. N. Husted, H. Sherrer, S. F. Morris, E. D. T. Gibson, J. W. Robie, H. M. Brush, Wm. C. Roberts, F. A. Burrall, R. J. O'Sullivan, Wm. C. McFarland. These gentlemen took the oath of office May 29th, and entered upon their respective duties May 31st, being proportioned among the several inspection districts under the immediate direction of the local medical officers. Drs. Burrall, O'Sullivan, and Purcell, were assigned to special duty in connection with the Public Schools; and Dr. Wm. C. Roberts was wholly engaged in vaccinating the children of the various industrial and charity schools throughout the city. On the 31st day of May I received from you the following:

NEW YORK, *May* 31, 1869.

E. H. JANES, M. D., *Sanitary Inspector, etc.*

DOCTOR: I hereby detail you to have sole charge of the vaccine virus employed in vaccinations by medical officers under direction of the Metropolitan Board of Health. Your duties under this appointment will be—

(1.) To inspect every charge, point, and quill, of the virus used in the service of the Board.

(2.) To superintend the cutting, packing, and daily distribution of the virus, and to carefully guard against the employment of any lymph, points, or quills, that may have been charged for a longer period than forty-eight hours; also to direct and insure the keeping of the virus in store each day, at a low temperature.

(3.) Daily to visit the chief sources of our daily supply of virus, and to cause every needed precaution and sanitary rule to be observed by persons who select and take the lymph.

(4.) To report at the Central Office of the Board once daily the information needed by the Sanitary Superintendent concerning virus and the wants of the vaccinating corps.

You will have one messenger and assistant for packing and distribution of virus.

Respectfully yours,
E. HARRIS, *Sanitary Superintendent.*

In accordance with these instructions I entered at once on the duties thus defined, visited daily the principal sources of our supply, observed carefully the class and condition of children from whom virus was taken, inspected every point and quill immediately upon its being received at the central office, rejecting all that exhibited the slightest trace of blood or purulent matter, and made daily distributions to each medical officer for the use of himself and his associates in the following manner: Every evening, at six o'clock, a sufficient number of fresh points, carefully packed in phials, was sent to each district medical officer to supply him and his associates during the succeeding day, the quantity usually being so graduated as to insure each day virus not more than twenty-four or thirty-six hours old; and the surplus was closely packed on dry cotton floss, in bottles, and placed on ice, as the best means of preservation. If, during the day, the stock of any inspector was likely to be exhausted, a telegram from the nearest police-station announced the fact at the central office, and the deficiency was at once supplied by a special messenger. The system thus inaugurated not only prevented any serious loss of time, but insured a very high degree of freshness and purity of the virus used, as we shall see when we come to treat of the very few cases in which unpleasant symptoms followed the operation of vaccination. Indeed, I think that no better guarantee for the good quality of the virus could be had, than the fact that it was all taken by persons well skilled in, and long accustomed to, this very delicate operation, and that it was subjected to a severe scrutiny before leaving the Central Office, and a third inspection by the district medical officer, before, or at the time of using.

The plan adopted for the prosecution of this work was as follows: Every District Inspector assigned a certain portion of his district to each of his associates, with the instructions that each house should be visited, commencing at one corner of a square, and passing entirely around to the place of beginning, presenting the subject of vaccination briefly to each family, that all might have the opportunity of availing themselves of the benefits of this generous provision. In all instances, special efforts were made to urge upon the poor, and the tenement-house population, the importance of vaccination and revaccination, and the peculiar advantages afforded in having its protective influence brought free of charge to their very doors, by the authority and sanction of the Board of Health. Those in better circumstances were urged to attend to the matter without delay, the preference always being given to the family physician; though none were refused the privilege of being vaccinated, and house-servants were particularly urged to its acceptance.

As a general rule, those squares in which small-pox was then or recently had been raging, received the first attention of each inspector, in order, if possible, to arrest the spread of the disease with the least possible delay; a measure, the salutary effects of which were very soon apparent in the rapidly-decreasing number of new cases daily reported at the Central Office.

This house-to-house visitation was kindly received by a very large majority of all classes; even those who did not stand in need of its benefits applauded this action of the Board of Health, and generally expressed a good deal of interest in its success. The poorer classes seemed particularly grateful, and very generally availed themselves of this opportunity to have their children vaccinated either by the Board's officer or some other person, to the prevention of a large amount of human suffering, and the preservation of many lives. Those who did not stand in need of this gratuitous service were nevertheless influenced by the general awakening on the subject which the plan thus adopted and presented had caused, and hence vast numbers applied to their family physicians, and received from them the necessary advice and protection. Others preferred going to the Dispensary, an old, time-honored custom most rigidly observed by a large class of the poor and the tenement-house population. In many of the poorer neighborhoods, a large amount of vaccinating is done by barbers, midwives, apothecaries, etc., all of whom contributed, to a greater or less extent, to promote the wishes of the Board, that vaccination should be made general throughout the city.

It is true that, among certain classes of the community, the effort was not so kindly received, and a series of objections had to be met, the management of which often severely tested the intelligence and ingenuity of the Inspector, in order to so dispose of them as to carry full conviction to his hearers. Among the most common objections advanced were:

1. Fear of communicating disease, and the occasional failure of vaccination to protect from variola; an objection emanating from the too frequent want of care in selecting genuine virus at the proper period of maturation, and the time and manner of inserting the same. When the medical profession will act as a unit in adhering to the golden rule laid down by Jenner, to use nothing but genuine eighth-day lymph from a perfectly-formed vesicle, we shall cease to hear of vaccination either communicating disease, or failing to protect from variola. It is true that the constitutional disturbance caused by the vaccine disease, or even the slight wound made by the lancet, independent of the specific nature of the virus employed, will often suffice to develop some inherent affection which otherwise might have long remained latent, had not some constitutional disturbance made manifest its peculiar characteristics. Thus is adenitis often developed in a strumous child by vaccination, however pure the lymph, or skilful and well-timed the operation.

2. Revaccination was considered by many unnecessary, and persons holding this opinion were generally fortified by a certain amount of medical authority, among which the opinion of the family physician is either correctly or erroneously quoted, and usually regarded as beyond contradiction.

3. Persons who had been inoculated in childhood were generally confident that they were permanently protected, though one severe case of variola appeared under my observation during the past summer, in a person who had in childhood been subjected to this operation, showing that even the protective influence of variola itself is not always permanent, when made to depend on a single inoculation.*

4. Many parents are opposed to vaccinating infants before they have arrived at the age of three or four months, such persons usually citing the authority of their family physicians, though, in cases of direct exposure, very few would neglect this precaution, however young the infant may be. The absence from home of one or both parents, the heat of the weather, the fear on the part of adults of the consequent sore arm, doubts concerning the purity of the lymph, and the natural distrust which many feel toward a stranger, operated in particular instances to a certain extent in causing many to decline the acceptance of free vaccination; though, in most of those instances, the Inspector succeeded in exacting a promise that the matter should not be neglected; and we have no

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* A certain class of adult Irish immigrants was found to have been inoculated in childhood, and these were the only persons that presented recent evidence of that obsolete practice.

reason to doubt that the Dispensary, the family physician, or some other source, supplied the want in a great majority of cases.

Very few of the adult male population were found at home, hence comparatively little was done toward affording the protective power of vaccination to this class of persons; the effect of which was very soon apparent, as it was among these that the few cases of varioloid occurred after the termination of these labors. Many, however, as well as the older children who were at school or at some employment during the day, were invited to call at the Inspector's house during the evening; an invitation which large numbers accepted, who were vaccinated during the evening or before working-hours in the morning.

From the fact that many of the children were at school at the time of the Inspector's visit, it was deemed necessary, in order to make thorough the work, and extend the advantages of vaccination to the greatest possible number, to reach many of them through the medium of the public schools; and, in order to accomplish this without encountering the spirit of opposition which was previously manifested on a similar occasion, the Board of Education was consulted, and that body respectfully asked for suggestions by which one of its own by-laws might be most easily and rigidly enforced. After due deliberation on the subject, the Board of Education adopted a resolution commendatory of this action of the Board of Health, and recommending the local Boards to afford all necessary assistance to the medical officers in the examination of school registers, and securing the vaccination of all unvaccinated children in attendance, it being distinctly understood that in all cases the consent of the parents should be first obtained. Many of the local School Boards at once adopted this course; the foremost being those of the Sixth, Seventh, and Eighth Inspection Districts, including the Seventh and Eleventh Wards. By the efforts of Dr. R. J. O'Sullivan, one of the School Trustees, and special Assistant-Sanitary Inspector, Dr. Charles C. Lee, Medical Officer of the Eighth Inspection District, assisted by Drs. W. J. Purcell and D. Dewitt Harrington, secured the vaccination of 1,415 school-children, 229 of these being primary vaccinations; and Dr. W. H. B. Post, of the Seventh Inspection District, meeting with similar encouragement, was enabled to secure the vaccination of 1,571 school-children, 172 being primary vaccinations; and Dr. J. T. Nagle, of the Sixth Inspection District, vaccinated 455 school-children, 61 being primary vaccinations. Dr. Ely, of the Eighteenth District, vaccinated 512 school-children, the proportion of primary vaccinations not indicated.

A much smaller number of unvaccinated children were found in the schools on the west side of the city. Dr. E. D. Hudson, Medical Officer of the Fourteenth Inspection District (Twenty-second Ward), vaccinated 1,149 school-children, only 11 of which were primary. Dr. Westcott reports visiting a school in the Ninth Ward and finding the name of but one unvaccinated child on the register. Dr. Randall, in the Fifth Inspection District, including the Sixth Ward, vaccinated 730 school-children, 120 being primary vaccinations; while, among 457 vaccinations of school-children in the Twentieth Ward, only two were primary.

But some of the Inspectors did not meet with the same encouragement from the local school officers as did those of the Sixth, Seventh, and Eighth

Districts. Thus, in the Twelfth District (Twentieth Ward), after the Inspector had sought and obtained the sanction of the chairman of the local Board, and had made arrangements with the different schools, appointing certain days for the prosecution of the work, a meeting of the Board was held and a resolution passed instructing the teachers to inform the children that all, whose parents desired it, could be vaccinated free of charge by calling at the Inspector's residence. The entire Board, with the exception of the chairman, strongly opposed vaccination in the schools, and the above resolution was the only compromise which the Inspector, who attended this meeting, was able to effect. In the mean time, the Principals of the several schools had notified the parents of the original intention of the Inspector, and had received from these parents, in return, a large number of written requests that their children might be vaccinated. This plan, however, being interrupted, it was finally arranged that the children visit the Inspector's house at stated hours in classes, two of the Principals kindly furnishing teachers to assist in keeping order and otherwise facilitating the work. In this manner the work proceeded, though I have every reason to believe that the number of school-children vaccinated was far less than it would have been had the original plan been executed.

Similar opposition was encountered in the Ninth, Eleventh, and Thirteenth Inspection Districts; yet, in the Ninth District, Dr. Westcott managed to vaccinate 129, and Dr. O. G. Smith 62 school-children. In the Eleventh District (the 18th Ward), Dr. Russell vaccinated 179, of which 105 were primary; and, in the Thirteenth District, Dr. Strang vaccinated at his own residence 266 school-children, 16 being primary vaccinations.

The principal objection made by the Trustees to vaccinating in the school-room was, the fear of its effects on the minds of young children. Something of a panic had occurred in one of the primary schools in the 21st Ward, caused by a mischievous paragraph in one of the morning papers, and this was cited with the usual amount of exaggeration, as one of the evil effects of introducing this subject to young children not under the immediate supervision of their parents.

Twenty-two Industrial and Charity Schools, including the News-boys' Lodging-House and similar institutions, were visited by Dr. Wm. C. Roberts, who vaccinated 956 of this class of children. In performing this task unaided, Dr. Roberts found it impossible to make a full record of his work beyond that of mere numbers, and it is therefore unknown what proportion of these children had been previously vaccinated. One Industrial School in the 20th Ward was visited by Dr. Duberceau, who vaccinated 19 children.

Of the unpleasant complications following the operation of vaccination, we have reports of six cases of erysipelas and erysipelatous inflammation, most of them recovering with little or no treatment; one case of badly-inflamed arm, one abscess in the axilla, and two cases in which an eruption over different parts of the body followed the operation.

Of the cases of eruption following vaccination, one exhibited the appearance of the vaccine vesicle in its early stages, and the other was clearly dependent on a premature rupture of the sore during the purulent stage, the discharge causing an excoriation in the vicinity of the sore which extended to wherever the right hand came in contact with different parts of the body, the eruption being clearly the effect of local irritation, caused by the purulent matter from the ruptured sore conveyed by the finger-nails of the child. Both of these cases recovered.

The proportion of cases in which unpleasant symptoms followed the operation so far as reported—and care has been taken to obtain full information on the subject—was, I believe, less than the usual average in private practice; and in this respect I think the care exercised, to secure, each day, lymph of unquestionable character as to freshness and purity, was not without its effect. Indeed, every possible precaution was taken to avoid these accidents, even to furnishing the Inspectors with new lancets; and these were submitted to frequent and thorough cleansing with carbolic acid.

The success of this undertaking has, I believe, been fully equal to the highest expectations of the Board or any of its officers. Small-pox, which threatened to overspread our city, was at once arrested, with the exception of here and there an isolated case, exceptions always to be met with in a cosmopolitan city, independent of any epidemic influence.* In view of this success, it would appear that the time has arrived for the establishment of a Vaccine Bureau in connection with the Board of Health, where fresh lymph can at all times be obtained, and the poorer classes supplied with gratuitous vaccination. A department of this kind under the care of a competent person, with sufficient assistance from time to time to meet such emergencies as the late outbreak of small-pox, would so far control the disease as to remove all fear of its appearance as an epidemic, and thus greatly promote not only the sanitary, but the social and commercial interests of our great city. To afford so high a degree of protection would require that the practice of revaccination should be adopted, as it is now a well-settled conclusion in the minds of the medical profession that the effect of a single operation is not always permanent, and that, in order to secure its full benefits, it should be repeated at intervals until it ceases to produce any of its characteristic effects.

In conclusion, I beg leave to add that a tribute of honor is due to those medical gentlemen not permanently connected with the Board, who, amid their private professional duties, devoted themselves so earnestly to this work from its commencement to its completion. The zeal with which they from day to day labored in the furtherance of this noble work, was actuated by motives far above the moderate pecuniary compensation they received, and will, I hope, be ever gratefully remembered by an appreciative public.

Respectfully submitted:

E. H. JANES, M. D.,

Sanitary Inspector of the 12*th District, for the Corps of Inspectors and Assistant Inspectors.*

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* Since writing the above, the following note has been received:

December 29, 1869.

E. H. JANES, M. D.,

DEAR SIR: At the tenement-house No. 342 East Forty-eighth Street, there were in September five cases of of varioloid, and the occupants admitted the proffer of revaccination by the Inspector in June, but declined, as they considered one vaccination sufficient. The result shows the importance of the course adopted by the Metropolitan Board of Health.

Yours truly,

AUGUSTUS VIELÉ.

Abstract of the Records of Vaccination by Sanitary Inspectors in June, 1869.

District.	INSPECTOR.	Families.				Schools.				Total Vaccinations.	REMARKS.
		No. of Families.	Pr. Vac.	Revac.	Total.	No.	Pr. Vac.	Revac.	Total.		
1.	W. F. Deming	957	150	361	511	6	84	230	314	825	
	J. W. Baldwin	1,734	166	61	227	......	......	......	......	227	
	Dwight Ruggles	1,656	334	45	379	......	......	......	......	379	
2.	Lewis Applegate	......	......	......	......	1	......	......	82	82	
	E. C. Passmore	......	166	68	234	5	......	......	720	954	
	Wm. F. Thoms	......	109	62	171	1	......	......	111	282	
3.	C. F. Roberts	97	18	37	55	5	41	294	335	390	
	E. McSweeny	2,248	71	10	81	......	......	......	......	81	
	H. Raphael	2,301	150	49	199	......	......	......	......	199	
	H. Brennan	1,102	133	151	284	......	......	......	......	284	
	J. W. Bowden	1,284	15	19	34	......	......	......	......	34	
4.	G. B. Smith	275	44	23	67	4	56	318	374	441	
	G. W. La Cato	1,186	102	69	171	1	7	37	44	215	
	B. F. Dawson	1,277	96	107	203	......	......	......	......	203	
	L. Dohme	1,318	58	30	88	1	......	35	35	123	One case of erysipelatous inflammation of the axilla. One badly-inflamed arm, after primary vaccination.
	J. J. Brownlee	263	23	......	23	......	......	......	......	23	
5.	F. J. Randall	1,813	196	619	815	......	120	730	850	1,665	
	B. M. Keeny	1,578	......	......	125	......	......	......	......	125	
	W. J. Welch	1,343	90	7	97	......	......	......	......	97	One case of erysipelas in a little girl aged five years, recovered.
	F. C. Curtis	4,020	247	89	336	......	......	......	......	336	
	F. J. Maynard	238	41	11	52	......	......	......	......	52	
6.	J. T. Nagle	2,045	158	42	200	2	61	455	516	716	
	W. Balser	3,498	203	24	227	......	......	......	......	227	
	W. T. Carpenter	2,140	198	96	294	......	......	......	......	294	
	W. P. Worster	2,107	87	49	136	......	......	......	......	136	
7.	W. H. B. Post	1,486	159	124	283	5	172	1,399	1,571	1,854	
	G. Wynkoop	1,250	104	88	192	......	......	......	......	192	
	W. T. Day	1,112	33	31	64	......	......	......	......	64	
	J. T. Kennedy	1,861	131	172	303	......	......	......	......	303	
	G. H. Butler	1,362	141	74	215	......	......	......	......	215	
8.	C. C. Lee	104	48	269	317	......	229	1,186	1,415	1,732	
	David Brekes	4,631	441	518	959	......	......	......	......	959	
	D. De W. Harrington	671	108	94	202	......	......	......	......	202	
	L. Le B. Hart	1,524	209	169	378	......	......	......	......	378	
	J. J. Brownlee	263	23	......	23	......	......	......	......	23	
	C. Stokes	364	16	5	21	......	......	......	......	21	
9.	N. S. Westcott	1,095	88	97	185	4	24	105	129	314	
	James Ross	1,759	78	55	133	......	......	......	......	133	
	O. G. Smith	1,311	91	116	207	1	26	36	62	269	
	J. J. Brownlee	1,916	152	66	218	......	......	......	......	218	

10.	L. Damainville	1,200	179	199	378					378	Two cases of slight erysipelatous inflammation following revaccination; both adults; no treatment.
	C. H. Ludlum	2,124	149	224	373					373	One case of abscess in the axilla, following adenitis after vaccination.
	C. J. Pardee	879	16	93	109	1	4	103	107	216	
	A. B. De Luna	2,311	82	130	212	1	6	173	179	391	
	S. B. W. McLeod	502	72	78	150	1	6	26	32	182	
	P. F. C. Deslandes	331	51	85	136	1		122	122	258	
11.	C. J. Russell	757	53	78	131	3	105	74	179	310	
	E. L. Keyes	2,498	144	106	250					250	
	J. F. Morgan	2,704	133	40	173					173	
	J. A. Robinson	1,515	193	60	253					253	
12.	E. H. Janes	655	68	33	101	3	2	455	457	558	
	C. F. Jay	2,246	203	46	249					249	
	J. A. Frazer	1,651	42	63	105					105	
	A. Duberceau	2,706	105	67	172	1	1	18	19	191	
	E. H. M. Sell	2,900	241	212	453					453	One case of erysipelas, with a vaccine eruption; and one case of eruption, caused by breaking the vesicle and transferring the virus by scratching.
	H. J. Smith	1,397	135	112	247					247	
	P. F. C. Deslandes	554	59	63	122					122	
	A. S. Heath	583	34	8	42					42	
	O. G. Smith	146	9	12	21					21	
13.	Albert Strang	1,049	177	48	225	3	16	250	266	491	
	F. J. Maynard	1,279	105	54	159					159	
	C. Stokes	1,026	73	21	94					94	
	H. E. Jones	1,455	155	119	274					274	
	W. B. Lewis	208	27	17	44					44	
14.	E. D. Hudson		45	55	100		11	1,138	1,149	1,249	
	F. E. Langdon	1,878	141	68	209					209	
	R. Tauszky	728	150	154	304			52	52	356	
	W. H. Van Wyck	544	197	125	322				196	518	
	S. W. Roof	960	151	144	295					295	
15.	Aug. Viele		165	46	211	1			95	306	
	A. A. Davis	2,009	248	34	282					282	One case of a child six months old, in which a vesicular eruption covered arms, legs, and part of abdomen.
	A. P. Williams	434	138	21	159					159	
16.	S. D. Wadsworth	287	172	59	231	7	61	11	72	303	One case of erysipelas, in a child two months old, following the operation of vaccination.
	J. E. M. Lordly		183	12	195					195	
	A. S. Heath	542	91	15	106					106	
17.	B. Gesner	772	34	102	136	1	54	388	442	578	
	I. B. Read	722	126	32	158					158	
18.	H. O. Ely		92	130	222	3			512	734	
	J. N. Husted	462	60	40	100					100	
	H. Sherer	1,500	150	100	250					250	
	S. F. Morris	1,993	56	13	69					69	
	E. D. T. Gibson	3,364	237	126	363					363	
19.	W. L. Hall	1,042	93	21	114	2	27	380	407	521	
	J. W. Robie	1,121	88	13	101					101	
	H. M. Brush	895	89	34	123					123	
	W. C. Roberts					22			956	956	
	Total	106,855			17,209				11,800	29,009	

III.

VACCINATION IN THE PUBLIC SCHOOLS.

E. Harris, M. D., *Sanitary Superintendent.*

Sir: I have the honor to report that, in accordance with your instructions, I visited officially the local School Boards of the Eighth, Ninth, Tenth, Fourteenth, Fifteenth, Sixteenth, Seventeenth, and Twenty-first Wards, for the purpose of arranging preliminaries for vaccination in the schools under their care.

After receiving the authorization of the Trustees, I then visited the schools in company with the Sanitary Inspectors, in whose districts these schools were situated, and, either personally or with the aid of trustees and teachers, we explained to the scholars the plan of vaccination for the schools, which had been adopted by the Board of Health.

Questions as to the right of the Board of Health to vaccinate in the schools were not discussed. The pupils were informed:

1. That the Board of Health offered to vaccinate all of the pupils in the public schools who required it, but that no forcible vaccination was intended.
2. That no child could be vaccinated without the consent of its parents.
3. No objection was made to the performance of the vaccination by the family physician.
4. That the vaccine virus for the intended vaccination was very carefully selected.

It was found that a sort of fear of forcible vaccination had crept into the schools, owing to incorrect newspaper statements, and consequently parents had, in many instances, kept their children at home. After it was learned that no forcible measures were to be used, a decided reaction ensued in favor of vaccination.

In those schools where medical men were among the trustees or teachers, efforts had already been made to secure a thorough vaccination of the pupils. In some schools teachers gave their aid and approval of the work, by offering to be vaccinated themselves.

As an instance of the necessity for the proposed vaccination, it was found, during our visit to one of the schools, that scholars were in attendance at this school, who lived in houses where small-pox was then prevailing, the teachers being unaware of the existence of the disease.

The registration of vaccination in the schools is not uniform, varying from satisfactory thoroughness to a certain degree of inattention. It would seem as if every scholar ought to present, on entering school, a certificate of vaccination from a physician, and a note of this should then be made under a special heading in the register.

A relation seems to exist between the thoroughness of vaccination in the schools and the intelligence of the people, and it is believed that the children of intelligent parents will show a much larger proportion of vaccinations than those who are more deficient in education.

It would be an omission to close this brief report without referring to the courtesy with which we were received in our visits, and it may also be added, that no good citizen can visit our public schools without being sincerely interested in their welfare. It is a natural desire that physical and mental education should receive an equal share of attention, and that every safeguard should be thrown about the health of schools. How comparatively valueless would be the finest attainments, if allied to a constitution enfeebled by the results of that disease which it has been the object of the present efforts to avert!

Yours very respectfully,
F. A. BURRALL, M. D.

IV.

E. HARRIS, M. D., *Sanitary Superintendent.*

SIR: I have the honor respectfully to report that, in obedience to orders received from you, I commenced, on June 1, 1869, the visiting of, and vaccination in, the industrial schools, under the charge of the Children's Aid Society, and during the month attended to the following establishments:

13th Ward Industrial School, 327 Rivington Street.
Girls' Lodging-house, 125 Bleecker Street.
Girls' School, 52 Market Street.
Boys' " 709 E. 11th Street.
Girls' " E. 14th Street and Avenue B.
" " 337 E. 35th Street.
News-boys' Lodging-house, 709 E. 11th Street.
German School, Second Street.
"Lord" " Greenwich Street.
Fifth Ward School, 141 Hudson Street.
School, 185 Spring Street.
" 116 Elizabeth Street.
No. 7 Industrial School, 337 W. 48th Street.
" " 150 W. 16th Street.
" " 211 W. 18th Street.
Lorimer " " W. 52d Street.
Hudson River " 350 W. 27th Street.
Italian School, 30 Franklin Street.

Making a total of eighteen schools.

The total number of vaccinations, as nearly as, in the hurry of business, I was enabled to record it, was about seven hundred, of which about fifty were primary and the rest secondary.

Besides the foregoing, I visited the House of Detention, West Thirteenth Street, and, assisted by its resident physician, vaccinated over fifty children, a few of which vaccinations were primary.

July 3d, I visited the Juvenile Asylum, One Hundred and Seventy-sixth Street, and again on July 11th. The total number vaccinated on these two occasions, of male and female children, exceeded two hundred, many of which were primary. The question of vaccination previous to, or on or after admission, not apparently having been made a matter of especial attention. Very many of these vaccinations were primary, and succeeded in a majority of instances; all which did not on the first, being repeated on the second visit.

On July 6th I visited the Colored Orphan Asylum, in which I vaccinated, or revaccinated, more than seventy children.

I visited, also, a number of other institutions (nine), but found their wants already provided for by the Sanitary Inspectors, or by other agencies.

June 21st, with Inspector Tauszky, I visited a school in Forty-eighth Street, under the patronage of the Home of the Friendless, and vaccinated about sixty children.

The total of these two series of vaccinations exceeds one thousand.

It gives me great pleasure to say that the efforts of the Inspector were greatly facilitated by the zealous coöperation of the intelligent lady teachers in these educational establishments. With very few exceptions, vaccination was readily submitted to by the children, and was performed in every case in which the cicatrix was the least doubtful in character, or where vaccination had not been performed. Had I known then what my subsequent experience has taught me, I would not have left a single arm untouched. Of the success of my vaccination, from what opportunities I had of judging, I entertained a very favorable opinion. In regard to other points connected with this interesting and important subject, I can add nothing to what has been said in the full and able reports of the zealous and intelligent Inspectors with whom I was associated. It will, perhaps, be well that I should say that a large proportion, with a single exception, of these scholars, had been vaccinated at least once, and many a second time.

Respectfully submitted:

Wm. C. Roberts, M. D.,

Assistant-Sanitary Inspector of Small-pox and Vaccination, Metropolitan Board of Health.

V.

RULES OBSERVED IN PUBLIC VACCINATION AND IN THE CONTROL OF SMALL-POX.

The rules which Dr. Jenner laid down for the practice of vaccination are exceedingly strict, and so very exact are they, that only the more intelligent and scrupulous class of medical practitioners even in his day complied with them. Yet the family physician, with every incentive to use all known means for securing the most perfect results and avoiding all sources of accidental inflammation, defective operation of the virus, etc., in his patient, has in many districts succeeded in keeping alive the true Jennerian methods and rules in the practice of vaccination.

The three essential points in the practice of vaccination by Dr. Jenner were the following, namely:

1. To select and employ only vaccine lymph from absolutely perfect vesicles, and from infants in good health, and from arms free from areola or other marks of inflammation at the time of taking the virus.

2. To vaccinate, when possible, directly from arm to arm, and in all vaccinations to use perfectly fresh lymph.

3. The quality and thoroughness of the vaccination should be attested by careful inspection of the eighth-day results of the operation, and, wherever defects are noticed or even possible, there should be reinoculation with fresh lymph.[*]

That these simple rules should be neglected by any physician would seem to be impossible, if he correctly appreciates the importance of individual protection as well as public security against small-pox. The correction of each neglect and defectiveness, as we witness in the private practice of vaccination, may be partially overcome by the influence of Boards of Health in their public vaccinations.

These simple and easily-observed rules should be strictly adhered to in public vaccination. They should be taught to the people in such manner that the duty of revaccinating every person once at least in the lifetime will be understood and willingly practised.

Rules that should regulate the Care and Cultivation of the Stock of Vaccine Lymph for Public Vaccination.—Two cardinal facts have been clearly demonstrated in the progress of seventy years' experience in the use of the kine-pock, viz.: (1.) That the fully effective attributes of vaccine virus, by special care, in the selection of persons and vesicles, can be enhanced and brought to a high degree of activity; and (2.) That a primary stock of vaccine can be procured by artificially infecting a heifer with genuine small-pox. The vesicles and crusts that form upon the udder and other parts of the cow are found to be imbued with the properties of vaccinia, which is the primary source of artificial protection against small-pox.[†]

Vaccination in cities and populous neighborhoods should be strictly enforced by all means which the laws afford: and in all portions of the State, however sparsely settled, no children should be permitted to attend the public schools without having been well vaccinated.

Revaccinations should be recommended and practised in all persons after the lapse of about fifteen years from the first vaccination of the individual.

Whoever chances to be exposed to small-pox contagion, or be in any place where small-pox is epidemic, should forthwith be revaccinated unless proved to be protected by previous and successful revaccination; and vaccination and revaccination should be performed upon all persons so exposed to small-pox as speedily as possible, for experience has proved that, if the vaccinial inoculation is performed thoroughly, even after the variolous contagion has been operating (incubating) for three or four days, it will, in most instances, give complete or partial protection against small-pox, and that even the partial and modifying effect of such vaccination diminishes the chances of a fatal attack of small-pox nearly twenty per centum.

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[*] In the earlier years of his experience, Dr. Jenner regarded it a duty to test every vaccination by subsequent inoculation with variola itself; but, having proved that reinoculation with vaccine lymph is fully as good a test, and infinitely less hazardous, he henceforth practised revaccination as the constant rule. This view of the duty of the vaccinator to give assured certainty of protection to every person vaccinated, though at times impracticable, is worthy of general regard, for it points out a rule of professional duty that should have few exceptions.

[†] This simple method of returning to the primary source of vaccinia is not to be lightly esteemed. Firmly as we may, in the present early stage of knowledge concerning the physiological history of vaccinia, believe that its perpetual generations or repropagations in man may not necessarily render it finally abortive or but partially protective, there is still much reason for endeavoring to maintain a frequently-renewed stock from the cow. Physiological knowledge and medical experience on this subject do not yet warrant us in casting aside the original method of renewing the fresh and healthful stock-virus which the heifer can supply, though there is constantly-increasing evidence that successive generations of vaccinia in the human family may be so conducted as to perpetuate all the prophylactic attributes of the virus unimpaired. Final conclusions on these questions cannot be reached in the present century. More facts must accumulate and be analyzed by careful observers before we can safely declare an independence of the original source of the kine-pock.

The fact should be constantly remembered by the people as well as by sanitary officers and physicians, that vaccination is simply a "pathological substitute" for small-pox, and that, to render this substituted virus absolutely protective under circumstances of great exposure to contagion, the vaccine lymph must be fresh and of good quality, and its insertion (inoculation) must be thorough. And it should be borne in mind, also, that revaccination is simply a test for remaining or restored receptivity of the individual to the vaccine and the variolous kinds of infection.

The occurrence of small-pox in persons that have been vaccinated, though rarely witnessed except when great numbers of unvaccinated children and other persons are suffering from the disease, an epidemic season, so called, or in persons directly and much exposed to the contagion, shows that it is needful that every person's vaccination should be so thorough as to remove all individual receptivity to small-pox, and especially that no person should neglect to be vaccinated in proper time.

The vaccinator should keep in view the fact, "that the protection afforded by vaccination is more complete, the more complete the development of the vaccine disease, and especially the more marked the impression made by it upon the system."

Also, "that where vaccination fails to impart absolute protection against small-pox contagion, it nevertheless modifies, in the majority of cases, the course of the disease, and renders it less fatal."

Also, "that the weakening of the protective power of infant vaccination is progressive, and that it occurs most rapidly during the period of most rapid bodily growth, namely, from infancy to puberty;" and, further, "that the return of receptivity for small-pox contagion (more or less complete) is a process in accordance with the general laws of physiology, and does not detract from the value of vaccination as a human invention."—(*Ballard.*) *

"Consider yourself strictly responsible for the quality of whatever lymph you use or furnish for vaccination. Take lymph only from subjects who are in good health; especially satisfying yourself that they are free from eruption on the skin. Take it only from well-characterized, uninjured vesicles. Do not take it from cases of revaccination. Take it (as may be done in all regular cases on the day-week after vaccination) at a time when the vesicles are plump, either just before the formation of the areola, or, at the least, not more than twenty-four hours after the areola has begun to form."

"In vaccinating from arm to arm, and still more in proceeding to store lymph, avoid draining any vesicle which you puncture. From such a vesicle as vaccination by puncture commonly produces, do not, under ordinary circumstances, take more lymph than will suffice for the immediate vaccination of five subjects, or for the charging of seven ivory points, or for the filling of three capillary tubes; and from larger or smaller vesicles take only in like proportion to their size."

* *Vaccination and its Value:* A prize Essay, by Dr. Edward Ballard, London, 1868.

"Scrupulously observe in your inspections every sign which tests the efficiency and purity of your lymph. Note any case wherein the vaccine vesicle is unduly hastened or otherwise irregular in its development, or wherein any undue local irritation arises; and, if similar results ensue in other cases vaccinated with the same lymph, desist at once from employing it."

[The last three of the foregoing rules are quoted without abbreviation, from the regulations at present in force under the Privy Council Medical Officers in England, in the management of vaccination by contract, and with this remark we conclude what needs to be presented from the rules that now guide the Medical Officers of the Metropolitan Board of Health in this branch of sanitary service.]

THE CONTROL OF INDIVIDUAL CASES OF SMALL-POX. ISOLATION AND DISINFECTION.

Recent improvements and resources in disinfection enable medical officers and attendants to make short and effective work in the management of small-pox contagion. Complete domestic quarantine (isolation) of whatever can communicate the contagion, and thorough and speedy disinfection of all clothing and other things, and the places that have by any means become infected, or that have been so exposed as to have been liable to such infection, are now counted among the most essential and definite of all sanitary rules.

The distance to which the contagion of small-pox may be communicated through the open air is unknown, but there is abundant reason to believe that, when small-pox is very prevalent in crowded neighborhoods, its contagious principle is frequently diffused by the atmosphere across streets and squares, and from house to house, especially where there is free exposure of unwashed and undisinfected clothing and bedding, as for example where blankets, quilts, or personal clothing of the sick or the dead are hung out in yards or upon the roofs. These facts render it quite important that our sanitary regulations should bring every kind of infected material and furniture under strict domestic quarantine and thorough disinfection, so that there shall be no possible diffusion of the virus beyond the apartment in which the infected materials are found.

What Disinfectants to employ.—Boiling water, or a temperature of 212° Fahrenheit, quickly destroys the contagious property of small-pox in whatever materials or places it may be held. This fact should be taught to every nurse and attendant in cases of small-pox.

Carbolic Acid.—The strong solution (one part of pure carbolic acid to ten, or not more than twenty-five parts of hot water), also the strong vapor of the pure acid, effectually destroys the contagion if so effectually applied as to thoroughly moisten or permeate the infected materials.

Sulphurous Acid Vapor.—Fumigation with sulphur should be practised in every apartment and closet in which the contagion exists or is suspected to lurk. It is a rule of the Metropolitan Sanitary Service, that the vapor of carbolic acid and the fumes of sulphur shall be employed in fumigating all infected apartments and materials, as soon as the sick persons are removed and before bedding and furniture are touched; this duty is performed under the immediate direction of sanitary officers.

The Methods of applying Disinfectants, and purifying Apartments.—As soon as the infected apartments and materials can be closed up for the purpose, the bedding and all other infected materials should be so arranged on chairs, etc., that every part of them shall be accessible to the disinfecting vapor and gases. Then proceed to the infected apartment or apartments, and, after saturating the beds, carpets, floor, and clothing, with carbolic acid, let the usual fumigation with sulphur be commenced, allowing the sulphur to be burned as long and in as great quantity as the oxygen in the closed rooms will maintain the combustion. From three to ten pounds of sulphur will be required for ordinary sick-rooms, and the adjacent closets and bedroom.

After fumigation there should be very thorough cleansing with boiling water, for whatever can be boiled or scrubbed, and with whitewash containing carbolic acid, and by long-continued ventilation with open windows, etc.

No article of furniture, clothing, or bedding, should be allowed to leave the infected premises, except by permission of medical officers.

Any public or private carriage that conveys a small-pox patient, or any infected materials, must be brought under the same sanitary control and purification as infected apartments and bedding, before being again used.

Other Duties.—The following memorandum, concerning the duties to be observed in families, and by sanitary officers, briefly shows what course is adopted by the Metropolitan Board of Health.

Vaccination of Persons exposed.—Immediately upon receiving information of the presence of a case of small-pox in a tenement or other dwelling, the medical officer of the district in which it occurs is required to proceed to offer to vaccinate and revaccinate every person in such dwelling and in each adjacent house, and, unless otherwise advised, this special vaccination should be continued from house to house until every person in the block is protected. Occasionally the supply of fresh lymph fails, and the effort to create a *cordon sanitaire* by means of vaccination is necessarily interrupted. Still, the rule to vaccinate all who need it throughout the entire block is obligatory, and should be adhered to as strictly as possible. In the rural villages and towns the same rule should be observed, and the vaccination extended throughout the entire neighborhood where the contagion is found.

Public necessity now demands that the duty of vaccination shall be performed in the best manner, and that the care and generation of the stock of vaccine virus shall be scrupulously attended to by physicians and officers of health. The report herewith given of the work of house-to-house vaccination in New York is submitted in the hope of promoting the observance of Dr. Jenner's rules in the universal application of this wonderful blessing to the human family.

E. HARRIS.

"B."

REPORT

OF

ASSISTANT-SANITARY SUPERINTENDENT

ON THE

OPERATIONS OF THE METROPOLITAN BOARD OF HEALTH, IN THE CITY OF BROOKLYN, FOR THE YEAR 1869.

To Elisha Harris, M. D., *Sanitary Superintendent.*

Sir: With the steady progress of the population of our city in sanitary education, through the teaching and influence of the Board of Health, and in respect for an authority capable of enforcing its wholesome demands, there has been during the past year an increased amount of sanitary work accomplished, with the machinery already in operation, through the more cordial coöperation of our citizens. This coöperation has been evinced by the extent to which the latter have availed themselves of the aid of the Board in securing the removal and abatement of sources of danger and discomfort.

The greater proportion of our work during the summer, exclusive of tenement-house cases, has consisted in response to these demands for our intervention, two thousand five hundred and eighty-four complaints of citizens having received attention during the year.

The strong hold which the Board has gained on the confidence of those who most need its supervision has been manifested in many ways; in none perhaps more clearly than in the nature of the complaints made at the Health Office, which have been far from being confined to matters of sanitary import, but have embraced numerous relations in which the complainants have felt their need of advice, and have manifested their confidence in the agents of the Board, as if they ascribed to it offices of guardianship and protection. But it is not by the tenement-house population only that the work and authority of the Board are thus appreciated. It has often happened that persons, about to build tenement-houses, or owning the same, and desirous of promoting the health and comfort of their tenants, have sought from the Board's officers, not only an authoritative interpretation of the "Tenement-house Law," but such information and suggestions, respecting the hygienic requirements of buildings of that nature, as the experience of the office enables it to furnish.

Articles of food and drink, which have excited suspicion from their appearance or taste, are constantly brought to us for examination, and, where simultaneous sickness in numbers of persons has aroused anxiety, the circumstances have found their way to the Health Office, and have been carefully investigated. Thus, in many ways, the range of usefulness of a sanitary authority, capable of exercising the beneficent influence contemplated in the organization of the Board of Health, is made manifest.

In the superintendence of the work of the Board in this city, the following considerations have been dominant: 1, faithful discharge of duty on the part of all the Board's agents; 2, economy in expenditure; and 3, coöperation as far as possible with other branches of the municipal government.

1. It was a wise provision of the law, constituting the Metropolitan Board of Health, which required its most important agents, those brought into most intimate contact with the people, to be chosen from such a class of men as has served in this city from the earliest organization of the Board—men of medical and sanitary education, capable of acting as advisers of the people, not seeking notoriety or political or personal influence, but thoroughly and unostentatiously discharging their weighty responsibilities, with the best interests of the city and a strict sense of duty serving as the prime motives of their official action. It is not often that the public secures servants of such a character; and it must be a source of satisfaction and security to the thoughtful part of the community to know that a body of men, possessing the qualifications I have mentioned, is abroad among the people, protecting poverty in crowded tenements from the indifference or cupidity of wealth, and ignorance from unforeseen misfortune, educating those who most need teaching, and guarding and saving that which every man holds most precious—life and health. I esteem it, therefore, one of my foremost duties, in preparing this report, to bear testimony to the self-sacrificing zeal of the Sanitary Inspectors of this city, knowing, as I do, their worth from intimate association, and recognizing that, had men of different character, attainments, and motives, been placed in these positions, the whole purpose of the Metropolitan Board of Health would have been marred and frustrated. Their work is not to be judged according to the ordinary standards of political perfunctory service, but belongs to a higher domain of benevolence and devotion to the public good.

2. Economy has been practised, by causing the entire expense of the abatement of nuisances to fall upon the owners of property which has been found in a condition detrimental to the public health, or upon the parties in whose interest nuisances have been maintained. It is true that this method of procedure is less prompt, and that the impression on the public mind of power and efficiency is less marked, than it would be if the Board maintained in its service a body of men whose labors might be at once directed upon the removal of sources of complaint, but the advantages of the plan adopted are also decided and manifest. There is less danger of abuse of power, or misdirected action; and, where a nuisance has been continued, in spite of our efforts to secure its abatement, it has been in those cases where the ownership of the property has been unknown, or where it has been impossible to fasten the responsibility in the case upon any particular individual, or where the owner, resolved on resisting the orders of the Board, has appealed to the courts, and sheltered himself under the "law's delay." The reproach has been brought against the Board, that nuisances of considerable magnitude have been allowed to continue long

after serious complaint against them has been entered. But no reasonable person will find fault with the action of the Board in patiently hearing testimony, and weighing deliberately its action, where the daily bread of numbers of laborers is dependent upon the industry which it is sought to suppress. Often a modification in the process of manufacture suffices to render entirely innocuous an industry before dangerous. Designing persons seek, by their complaints, to make the Board of Health an instrument of their malevolent purposes, and it must carefully guard against their machinations. Our experience has been that, in those cases where there is least honesty in the intentions of complainants, there is loudest complaint, not to the Board, but to the public, which knows nothing of the real circumstances of the case; where there is a just cause, appeal is made to the Board.

The fact has been manifest that the sanitary recommendations and orders of the Board have had in them such a degree of reasonableness in their motives and prospective results, and have so recommended themselves to the good sense of the people, that in the great majority of cases they have been complied with without demur or opposition, thus rendering the exercise of compulsory measures or the employment of special agents unnecessary. Less than one-sixteenth of the orders of the Board have, during the past year, required the intervention of the courts; so that, as far as this city is concerned, the legal arm of the Board is useful mainly in giving the assurance to the obstinate and thoughtless that it has the power to command compliance with its requirements.

3. The most extravagant ideas exist throughout the great body of citizens, unacquainted with the details of our municipal government, respecting the scope of the Board's responsibilities. It is commonly supposed to have power to clean filthy streets and to remove garbage and dead animals, and, if neglect occurs in any of these respects, complaints pour in upon the office of the Board. Whether this fact is an indication of what ought to be the Board's powers, there might be a difference of opinion, but it is certain that the Board bears the blame of every dereliction of duty in respect to the above very important matters of public health. It is but just, however, to testify that, in no previous year of its existence, has there been less ground for complaint in these respects than during the past year; and, when the municipal authorities having these matters in charge have been appealed to from this office, the appeal has met with respectful attention, and the cause of complaint, with prompt remedy. On report of the Sanitary Inspectors, the Water and Sewer Commissioners have drained ponds of stagnant water, cleaned filthy streets, repaired broken and dangerous pavement, and remedied imperfect or obstructed culverts. Dead animals have been promptly removed in response to notification from this office, and that on occasions when the extent of the favor has been widely manifest.

The extent to which the Board of Health enlarges the usefulness of other branches of the municipal government, and makes them tributary to the sanitary well-being of the city, ought to be a source of pride, and the Board's dependence fairly acknowledged. The judges before whom our violations of the code of sanitary ordinances have been brought, have acted in accordance with the sanitary interests of the city, and it is to their coöperation with the Board that a large share of its efficiency in this city is due.

From the office of the Tax Commissioners and through their friendly aid, we have been enabled to determine the ownership of property, and the responsibility of violations of sanitary ordinances.

To the Bureau of Vital Statistics the coroners have lent important information, in determining carefully (by *post-mortem* examinations where necessary) the real cause of death in cases falling under their cognizance, and have demonstrated that the office of coroner should always be filled by an educated physician, as no one but a physician is a competent judge of causes of death.

Such, in fine, has been the general character of the work of the Board of Health in this city, and the nature of our relations with other departments of the city government.

The most important work which has been accomplished by the Board in this city has been that upon tenement-houses, by which over 2,500 populous dwellings have been brought into compliance with the law of 1867. This law provides that no dark bedrooms shall be allowed to exist, but that every sleeping-apartment shall, unless open to the air, have transom windows connecting it either directly or indirectly with a ventilated hall. It provides also that all privies shall have sewer connection, and pronounces all cellars uninhabitable that do not fulfil certain hygienic conditions. Thus a supply of fresh air and the removal of the most dangerous malaria are secured to this class of habitations. Into this work my predecessor, Dr. J. T. Conkling, entered with zest, and it remained to me but to carry out the measures which he had initiated. The tenement-houses in Brooklyn are not the source of danger and reproach that they are in New York. It is only in the 14th Ward that there are a few front and rear tenements on the same lot, and there are but few of over three stories in height. The following summary of the results of a "sanitary survey" of 532 tenement-houses, in the 7th, 14th, 16th, 19th, and 20th Wards, gives a fair estimate of the prominent features of this class of habitations in this city. On the appointment of three Assistant Inspectors in June last, this survey occupied their attention until the number of citizens' complaints, increasing with the heat of the season, demanded their care to the exclusion of this work.

Of the 532 tenement-houses visited for the purpose of the "survey," 22 were of two stories, 436 of three stories, 73 of four stories, and 1 of five stories; 269 were built of brick and 263 of wood; 95 contained a population of from 10 to 15 persons, 185 of from 15 to 20; 145 of from 20 to 25; 58 of from 25 to 30; 34 of from 30 to 35; 7 of from 35 to 40; 5 of from 40 to 45, and 3 were unoccupied. In 424 the general condition was good, in 108 it was bad; in 451 the house drainage was good, in 81 it was bad; in 207 the privies were flushed, in 325 not flushed; in 66 the cellars were wet or unwholesome, in 466 dry and healthy; in 201 there was good hall ventilation, in 331 the halls were badly ventilated; in 316 garbage was thrown in the streets or yards, in 216 it was properly removed. The depth of open space in the rear of the house was noted in 411 tenement-houses; in 393 it was over fifteen feet, in 28 only, under 15 feet.

The results of this "survey" prove that this city contains no vast agglomerations of humanity under the worst hygienic conditions; while it points out clearly defects which have, for the most part, been remedied since the survey was made. The labor of the Board, in the improvement of the tenement-houses of Brooklyn, as recorded in the official registers, is indicated in the following table. The results here presented are the work of five Sanitary Inspectors and five Assistant-Sanitary Inspectors, the latter holding their positions during the summer only—three last summer, and two for the summer previous.

TABLE, GIVING THE NUMBER OF TENEMENT-HOUSES INSPECTED, AND THE NUMBER BROUGHT INTO CONFORMITY WITH THE LAW BY EACH SANITARY INSPECTOR:

INSPECTOR.	1868.		1869.	
	NO. OF HOUSES INSPECTED.	NO. OF HOUSES IMPROVED.	NO. OF HOUSES INSPECTED.	NO. OF HOUSES IMPROVED.
No. I	460	398	108	159
" II	389	350	155	175
" III	353	278	110	108
" IV	224	209	24	30
" V	139	88	80	117
" VI	69	53	51	48
" VII	63	52	...	...
" VIII	262	171	...	...
" IX	....	....	290	386
" X	....	....	105	77
Total	1,959	1,599	923	1,000

Total number inspected........2,882
" " improved........2,599

Of the total number brought into conformity with the law, 78 were reinspected on the completion of the sewer in the Sixteenth Ward, last year, and required to make sewer connections, so that the total number of houses improved was 2,521 up to January 1, 1869. The owners of 1,599 tenement-houses had placed ventilators in their halls, opened dark bedrooms to the air and light, put up fire-escapes, rebuilt privies, and introduced sewer connections, had cleaned or whitewashed their walls—one or all of these as found requisite. Between January 1 and September 30, 1869, 1,000 tenements have undergone the same alterations. The total number of inspections, 2,804, represents approximately the number of tenement-houses in the city. The following are the streets in which more than twenty have received the attention of the Board:

Atlantic Street, Atlantic Avenue, Bridge Street, Broadway, Carroll Street, Church Street, Columbia Street, Conover Street, Dean Street, Degraw Street, Ewen Street, East Warren Street, First Street, E. D.; Front Street, Fulton Avenue, Flushing Avenue, Grand Street, Gold Street, Graham Avenue, Hicks Street, Hudson Avenue, Hamilton Avenue, John Street, Leonard Street, E. D.; Myrtle Avenue, Montrose Avenue, Meserole Street, North 2d Street, North 5th Street, North 6th Street, North 7th Street, Navy Street, Pacific Street, President Street, 2d Street, State Street, Smith Street, W. D.; Sackett Street, Stagg Street, Scholes Street, Union Street, Van Brunt Street, and Water Street.

The cellars in this city occupied as abodes of human beings are but few, and all which have been so occupied, in violation of the law, have been vacated. The summer was chosen as the season, when ejectments would cause least hardship, if leaving an unwholesome abode can properly be called a hardship. The difficulty does not consist in the ejectment of the cellar population, but in keeping the cellars uninhabited. Both cellars and tenements require constant supervision; and, should the sanitary control of the streets and public places never pass into the hands of the health authorities, there will always remain enough to occupy their attention in causes of disease within this class of habitations.

The following tables show the amount and character of the work of the sanitary inspectors of Brooklyn for the past year. They are obtained by consolidating the weekly reports to the Board into quarterly and annual tabulations:

CONSOLIDATED REPORT OF THE SERVICES RENDERED BY THE SANITARY INSPECTORS OF BROOKLYN FOR THE QUARTER ENDING DEC. 31, 1868.

NATURE OF NUISANCES.	Inspections.	Complaints.	No Cause.	Violations of Code.	Contagious Diseases.	Reinspections.
Tenement-houses	1,566	321	339	....	....	906
Privies and water-closets	764	26	120	144	....	474
Cellars, basements, and areas	453	154	219	29	....	51
Sewerage and drainage	386	34	57	75	....	220
Vacant lots, yards, and ponds	282	71	40	46	....	125
Private houses	193	6	137	6	14	30
Stables, manure, and manure-vaults	166	30	32	34	....	70
Streets, sidewalks, and gutters	125	11	11	41	....	62
Leaders, cisterns, cesspools, etc.	63	1	7	18	....	37
Dangerous buildings	21	9	4	1	....	7
Factories and distilleries	20	4	4	2	....	10
Stoops and roofs	19	....	11	2	....	6
Water and sewer pipes	13	....	1	4	....	8
Garbage, ashes, etc	9	....	....	6	....	3
Rendering establishments, etc	8	5	....	3	—	—
Animals	8	....	2	3	1	2
Hydrants, pumps, etc	8	1	....	3	....	4
Chimneys	8	1	....	1	....	6
Excavations and embankments	7	2	1	....	....	4
Slaughter-houses and butcher-shops	6	3	3	—	—	—
Lime-kilns	5	....	....	....	....	5
Smoke-houses, chemical-works, etc.	4	....	2	1	....	1
Bakeries and rope-walk	4	....	4	—	—	—
Trees	3	....	....	2	....	1
Hospitals	2	....	2	—	—	—
Oyster-shell heaps	2	....	....	1	....	1
Market	1	1	—	—	—	—
Hotel	1	....	....	....	....	1
Ridgewood water	1	....	1	—	—	—
Total	4,148	680	997	422	15	2,034

CONSOLIDATED REPORT OF THE SERVICES RENDERED BY THE SANITARY INSPECTORS OF BROOKLYN FOR THE QUARTER ENDING MARCH 31, 1869.

NATURE OF NUISANCES.	Inspections.	Complaints.	No Cause.	Violations of Code.	Contagious Diseases.	Reinspections.
Tenement-houses	1,242	298	211	1	3	729
Privies and water-closets	668	35	48	181	....	404
Sewerage and drainage, hydrants, leaders	409	41	68	89	....	211
Cellars and areas	361	64	68	7	....	222
Private houses	141	3	125	1	8	4
Streets, sidewalks, and gutters	177	31	21	85	....	40
Vacant lots, yards, ponds, and excavations	127	19	12	37	....	59
Stables, manure, and manure-vaults	106	30	29	14	....	33
Dangerous buildings	36	1	5	7	....	23
Factories, breweries, and distilleries	23	3	8	4	....	8
Rendering establishments, bone and fat boiling	10	4	....	....	....	6
Animals, dead animals, offal, etc	10	1	4	2	....	3
Chimneys and roofs	10	....	1	2	....	7
Schools, asylums, and public institutions	12	2	8	....	....	2
Markets and slaughter-houses	9	....	5	2	....	2
Wells	7	4	2	....	....	1
Ashes, garbage, etc	6	....	....	....	....	6
Theatres	4	2	2	—	—	—
Cisterns	3	1	....	....	....	2
Awnings	2	1	....	....	....	1
Gas	2	....	2	—	—	—
Store-house	1	....	1	—	—	—
Bridge	1	1	—	—	—	—
Piggery	1	....	....	1	—	—
Ferry	1	1	—	—	—	—
Alley	1	....	....	1	—	—
Tannery	1	....	—	....	....	1
Dumping-ground	1	....	—	....	....	1
Total	3,372	542	620	434	11	1,765

CONSOLIDATED REPORT OF THE SERVICES RENDERED BY THE SANITARY INSPECTORS OF BROOKLYN FOR THE QUARTER ENDING JUNE 30, 1869.

NATURE OF NUISANCES.	Inspections.	Complaints.	No Cause.	Violations of Code.	Contagious Diseases.	Reinspections.
Tenement-houses	2,234	662	309	27	14	1,222
Privies, etc	1,399	134	113	370	....	782
Sewerage, drainage, cisterns, cesspools	752	121	90	173	....	368
Vacant lots, yards, ponds, etc	324	37	33	69	....	185
Stables, manure, garbage, offal, etc	295	18	73	101	....	103
Streets, gutters, and sidewalks	254	57	23	97	....	77
Cellars, basements, areas, and hallways	254	46	38	30	1	139
Private houses	200	4	126	21	34	15
Factories, chemical-works, brewery, and distillery	44	8	13	7	....	16
Ferries	18	3	....	....	....	15
Slaughter-houses, butcher-shops, etc	18	2	7	5	....	4
Chimneys and dangerous buildings, etc	19	8	3	3	....	5
Animals	14	1	6	4	....	3
Stoops and roofs	7	....	....	4	....	3
Awnings	6	....	....	3	....	3
Piggeries	5	....	1	1	....	3
Schools and public institutions	4	3	1	—	—	—
Soap, bone, and fat boiling	4	....	2	2	—	—
Planing-mills	4	1	3	—	—	—
Theatres	3	1	1	....	....	1
Iron-founderies	2	....	2	—	—	—
Dumping-grounds	2	....	....	....	....	2
Dead bodies	2	1	....	....	....	1
Well	1	1	—	—	—	—
Hospital-ship	1	....	1	—	—	—
Engine-house	1	1	—	—	—	—
Boarding-house	1	1	—	—	—	—
Total	5,868	1,110	845	917	49	2,947

CONSOLIDATED REPORT OF THE SERVICES RENDERED BY THE SANITARY INSPECTORS OF BROOKLYN FOR THE QUARTER ENDING SEPT. 30, 1869.

NATURE OF NUISANCES.	Inspections.	Complaints.	No Cause.	Violations of Code.	Contagious Diseases.	Reinspections.
Privies, water-closets, cisterns, and cesspools.	1,658	92	169	480	....	917
Tenement-houses	1,237	173	249	24	40	751
Sewerage, drainage, and grading	870	78	72	146	....	574
Lots, yards, excavations, and ponds	672	162	49	129	....	332
Stables, animals, manure, etc.	538	82	71	178	....	257
Streets, sidewalks, and gutters	207	94	30	37	1	45
Cellars, basements, areas, and alleys	195	36	24	42	....	93
Private houses	144	8	74	21	17	24
Factories, gas-works, store-house, etc.	88	7	26	12	....	43
Hydrants, pumps, and leaders	61	5	17	8	....	31
Slaughter-houses, butcher-shops, etc.	32	5	9	8	....	10
Halls, stairs, stoops, roofs, and fences	26	....	2	3	....	21
Chimneys and smoke-pipes	24	....	2	7	....	15
Junk-shops, milk-depots, and sugar-press	21	....	8	5	....	8
Bone-boiling, fat-melting, and shell-burning	20	2	1	9	....	8
Dangerous buildings	9	....	3	2	....	4
Chemical-works, distillery, and tannery	4	1	....	1	....	2
Schools and other public institutions	3	1	1	1	—	—
Hotels	3	....	1	1	....	1
Ships	2	....	2	—	—	—
Pork-packing establishments	2	....	2	—	—	—
Scavenger carts	1	....	1	—	—	—
Ice-box	1	....	....	1	—	—
Hay	1	....	1	—	—	—
Total	5,819	696	814	1,115	58	3,136

CONSOLIDATED REPORT OF THE SERVICES RENDERED BY THE SANITARY INSPECTORS OF BROOKLYN FOR THE YEAR ENDING SEPT. 30, 1869.

NATURE OF NUISANCES.	Inspections.	Complaints.	No Cause.	Violations of Code.	Contagious Diseases.	Reinspections.
Tenement-houses	6.279	1,454	1,108	52	57	3,608
Privies, water-closets, cisterns, etc.	4,555	289	457	1,193	....	2,616
Sewerage and drainage, hydrants, leaders	2,486	280	304	494	....	1,408
Vacant lots, yards, excavations, ponds, etc.	1,415	291	135	281	....	708
Cellars, basements, areas, alleys, etc.	1,264	300	349	109	1	505
Stables, manure-vaults, animals, etc.	1,152	112	217	342	1	480
Streets, sidewalks, and gutters	763	193	85	260	1	224
Private houses	678	21	462	49	73	73
Factories, breweries, distilleries, etc.	216	24	71	32	....	89
Dangerous buildings, chimneys, etc.	127	19	18	23	....	67
Slaughter-houses, butcher-shops, etc.	66	11	24	15	....	16
Halls, stairs, stoops, roofs, and fences	52	....	13	9	....	30
Rendering establishments—bone, fat, swill boiling, etc.	42	11	3	14	....	14
Schools and other public institutions	21	6	12	1	....	2
Ferries and bridges	20	5	....	....	....	15
Ridgewood water, and water and sewer pipes.	14	....	2	4	....	8
Wells	8	5	2	....	....	1
Awnings	8	1	....	3	....	4
Piggeries	8	....	1	3	....	4
Theatres	7	3	3	....	....	1
Lime-kilns	5	....	....	....	....	5
Hotels	4	....	1	1	....	2
Hospital and other ships	3	....	3	—	—	—
Trees	3	....	....	2	....	1
Pork-packing establishments	2	....	2	—	—	—
Gas	2	....	2	—	—	—
Dead bodies	2	1	....	....	....	1
Engine-house	1	1	—	—	—	—
Boarding-house	1	1	—	—	—	—
Scavenger-carts	1	....	1	—	—	—
Ice-box	1	....	....	1	—	—
Hay	1	....	1	—	—	—
Total	19,207	3,028	3,276	2,888	133	9,882

VIOLATIONS OF THE CODE DETERMINED FOR THE YEAR ENDING SEPTEMBER 30, 1869.	Quarter ending 31st December, 1868.	Quarter ending 31st March, 1869.	Quarter ending 30th June, 1869.	Quarter ending 30th September, 1869.	Totals.
Abated on preliminary notices	378	229	502	894	2,003
" and defendant fined costs	8		11	19	38
" " case dismissed without costs	23	1	1	4	29
" " defendant fined $60	1				1
" " " " 25	3		3	2	8
" " " " 15 or twenty-five days			1		1
" " " " 15			1	1	2
" " " " 5	1				1
" but appealed for trial by jury				1	1
" and complaint withdrawn			1	5	6
Partially abated				1	1
" " and complaint withdrawn	3			1	4
Not abated; defendant fined $25				1	1
Complaints withdrawn	12	7	8	10	37
Total	429	237	528	939	2,133

REINSPECTIONS ON ORDERS OF THE BOARD.	Complied with.	Not complied with.	Partially complied with.	Total.
For the Quarter ending December 31, 1868	16	13	9	38
" " " " March 31, 1869	3	2	3	8
" " " " June 30, 1869	35	26	55	116
" " " " September 30, 1869	51	53	25	129
Total	105	94	92	291

REINSPECTIONS ON PRELIMINARY NOTICES.	Complied with.	Not complied with.	Partially complied with.	Total.
For the Quarter ending December 31, 1868	993	688	315	1,996
" " " " March 31, 1869	840	666	251	1,757
" " " " June 30, 1869	1,405	952	474	2,831
" " " " September 30, 1869	1,691	867	449	3,007
Total	4,929	3,173	1,489	9,591

COMPLAINTS OF CITIZENS, ETC.

For the Quarter ending December 31, 1868	462
" " " " March 31, 1869	419
" " " " June 30, 1869	814
" " " " September 30, 1869	889
	2,584

CONTAGIOUS DISEASES.	Scarlet Fever.	Small-pox.	Diphtheria.	Typhoid Fever.	Scarlet Fever and Diphtheria.	Typhus Fever.	Cholera.	Spotted Fever.	Total.
For the Quarter ending Dec. 31, 1868...	167	14	18	21	3	......	......	......	223
" " " " March 31, 1869.	269	11	32	12	4	1	......	1	330
" " " " June 30, 1869..	152	43	12	4	4	2	......	......	217
" " " " Sept. 30, 1869..	63	45	10	14	......	4	3	......	139
Total.	651	113	72	51	11	7	3	1	909

In order that the labor which the foregoing tables indicate may be clearly understood, it will be necessary to explain the method pursued by the Health Office in securing the abatement of nuisances. The entire city and county are divided into districts, each district being under the care of a Sanitary Inspector. Any violation of the Health Law or Ordinances, which the Inspector observes on his tour of inspection, is reported under oath, upon a blank form, giving the name of the offender or owner of the offending property and the nature of the complaint. The complaint is registered, and a preliminary notice, stating the requirements of the law, and fixing a date according to the urgency of the case, beyond which the nuisance will not be tolerated, is served on the offender by an officer of the police. When the time allowed has expired, the Inspector reëxamines the premises, and, if the nuisance is found abated, states the fact, and his report is registered against the complaint which is now withdrawn. If, however, the requirements of the Health Law, as stated in the preliminary notice, are not found complied with on reinspection, the complaint is sent to the Board. The Board's order in the case is served upon the offender. When the time given in the order for the abatement of the nuisance has expired, the Inspector again visits the premises, and, if the nuisance is found still existing, the Board orders its attorney to prosecute, and the penalty prescribed by law is exacted, or, if the order is complied with under the pressure of the law and the fear of the penalty, the case is dismissed by the judge on the payment of costs.

In ordinary violations of the Code of Sanitary Ordinances, the judge issues his warrant on complaint of the Inspector, and a time is fixed for the hearing of the case; meanwhile the premises are reinspected, and, if the nuisance is found abated, the Inspector so reports it when the case is called, and the judge dismisses the case on the payment of costs; if not, he imposes a penalty for the infraction of the sanitary code. The aim of legal proceedings has ever been to secure the abatement of the source of danger to the public health, not to accumulate a fund from penalties.

Since the winter of 1864 and '65, there has not been as much small-pox in the metropolis as during the past spring and summer. It became necessary, therefore, to take unusual precautions against the spread of the disease. When a case of small-pox is found in a crowded tenement, where it is impossible to isolate the disease, it has been customary to require the removal of the sick person to the County Hospital. But with a large portion of our population a most unwarrantable prejudice against all hospitals exists, and attempts at forcible removal are liable to be attended by violent resistance; in very few cases, therefore, has forcible removal been resorted to; every resource of advice and persuasion is made use of to bring about a voluntary segregation; were a different course pursued, greater pains would be taken than are already resorted to, to hide the disease from the eyes of the authorities. Parents will suffer their children to die, rather than call in a physician who would report the case to the Board of Health, as we have learned from repeated instances. Whenever a case of small-pox has been reported, the Inspector of the district has vaccinated all the families in the tenement, as well as in every tenement in the block in which the disease has occurred; and, if it has been thought inexpedient to send the sick person to the hospital, instructions for the use of disinfectants, and for guarding against the spread of the disease, have been given. When there is a physician in constant attendance, these instructions are generally obeyed; but dangerous recklessness pervades a large portion of the community to such an extent as to warrant recourse to decided and apparently cruel measures on the part of the authorities. The thoughtless do not reflect that a few pustules of varioloid, insufficient to confine the diseased person to his room, or to prevent him from riding in the cars and stages, will convey to some unfortunate victim a loathsome eruption which may mar forever loveliness of feature, or result in protracted illness, or in death. When the case is removed to the hospital, the patient is not discharged until all danger of contagion has passed; and the Health authorities feel relieved from a source of anxiety and watchfulness, as soon as the case is thus safely quarantined; but they deem it expedient to persuade by every argument rather than to exercise force.

With respect to the recent outcry against vaccination, it is as wicked as it is disastrous.

In reviewing the results of the past year's work of the Board in this city, legitimate grounds of pride and satisfaction present themselves; of pride in the aims and influence of the Board, and satisfaction in the amount of good wrought through its agency. But much remains undone, and a much higher grade of popular intelligence and rectitude must exist before the agency of sanitary authorities can be dispensed with. With sanitary agency of the utmost efficiency, these characteristics must be a community's main reliance for security.

When the well-paved streets of our city are swept or flushed every morning before daylight, and at the same time every dead animal, and all ashes, garbage, and filth, are removed; when a few large abattoirs take the place of numerous scattered slaughter-houses; when gas companies locate their works far out in the country; when livery-stables empty manure-vaults by night; when factories of all kinds consume their own smoke and fumes, or carry them high into the air; when cow-stables have been banished and condensed-milk establishments have multiplied among the rich farms around the metropolis; when places of public resort are supplied with special and adequate provision for ventilation; when no tenement-houses exist which do not subserve the health of their occupants as well as the gain of their owners; when every house and lot in the city shall be sewered and drained; when free public baths shall be provided; when unwholesome or adulterated food shall not be exposed for sale, for fear of detection and punishment; when all these very practical and desirable results shall have been obtained, there will still remain abundant demand for watchfulness on the part of sanitary authorities, to hold fast what has been gained, and to improve what is still inadequate and imperfect.

Fuller details of the work accomplished during the past year will be found in the reports of the Inspectors and Assistant Inspectors, which are herewith transmitted.

Dr. F. H. COLTON reports as follows: I have the honor to submit the following Annual Report:

The First District, of which I have had charge during the past four years, comprises the 6th and 12th Wards.

The end kept steadily in view has been a better sanitary condition of the District, as well as a more thorough understanding, on the part of citizens, of sanitary laws. This last result, so far as accomplished, has been brought about incidentally to the necessary intercourse with citizens, whose attention has been called from time to time to certain sanitary defects in their property. And it is quite noticeable that, as the history of the Board advances, less and less persuasion has to be employed to induce a willing compliance with its orders, and obedience to its ordinances. A part of this result, I am sure, ought to be ascribed to the conviction already brought about, that the Health Laws are salutary, and justly administered.

The work during the past year has been one of general supervision, without any one feature standing out prominently to distinguish it. In this it has been unlike that of the year previous, in which the tenement-houses were reported upon and modified according to the Tenement-house Law. But the fruits of that work have been reaped this year, in the increased comfort of the crowded population of these houses; while it must have been one factor to produce the low ratio of mortality which has characterized the past season.

The following have been the principal matters calling for attention:

Cellars.—At the beginning of the year an inspection of cellars was made; about sixty (60) were found inhabited, while altogether unfit for dwellings, whether judged by the ordinary laws of hygiene, or the requirements of the statutes. In many cases the tenants objected strongly to moving. The inclemency of the season, the difficulty of finding rooms, and inability to pay for any better apartments (the last most strongly and most frequently), were all urged, on the part of this underground population; while the argument was meant to be clinched by the constantly-repeated assurance, "We find very good health here," or "We were never better in our lives;" and this, too, when the room would be too dark at midday to distinguish faces easily, or its walls damp as a tomb with oozing moisture.

The fact, that, with few exceptions, all these underground rooms have been vacated, and more comfortable quarters have been found, and the rent has been met, proves the speciousness of the pleading. The claim that such tenements can be healthy needs no refutation.

A few of the worst cellars which had been once vacated under notification from the Health Office, I recently found occupied again. In these cases, and without any preliminary notice, I caused warrants of arrest to be served on the occupants, they having full knowledge that the apartments had been condemned as dwellings.

Under this process they were promptly vacated, and will not, I think, be again occupied for the same purpose.

Sewerage.—The Sewer Board has not been operating to any extent during the past year, either in the 6th or 12th Ward; and consequently there are the same evils arising from a lack of sewerage as existed a year ago. A large district in the 12th Ward is under contract, however, and the work has been commenced. A year will be required for its completion. It is to be hoped, therefore, that, before the Board of Health shall call for another Annual Report, substantial relief will have been given to this ward, which has suffered so severely on account of a lack of adequate sewerage, a lack which has rendered to a considerable degree ineffective the efforts put forth for its sanitary improvement.

Though the system of main sewers has not been extended during the year, many house connections have been ordered and made with those already laid, and thus local causes of filth and unhealthiness have been removed.

Vacant and Sunken Lots.—These have always been a fruitful and just cause of complaint; and therefore efforts have been made every year to diminish their number and offensiveness. If simply vacant, such lots have afforded a most convenient dumping-ground for house garbage and all manner of refuse matter and dead animals. When sunken as well as vacant, they have, in addition, been basins to hold large ponds of stagnant water, which would become only the more offensive from the animal and vegetable matter deposited in them. Through the influence of the Board, and the enterprise of private citizens, this evil has been considerably diminished during the past year. Perhaps the worst of this class of nuisances was a large pond in the 12th Ward, spreading more or less over several blocks; the boundaries of the basin being Columbia, Richards, Nelson, and Van Dyke streets. It was occasioned by neglecting to construct a culvert under Ginger-Mill Creek, when Columbia Street was extended. The attention of the Water Commissioners having been called by the Board to this interruption to natural drainage, they have remedied the evil. Several other ponds, which were referred to in my last annual report, have been drained through the same influence, operating in the same direction; others have been filled in or drained by the owners, upon notification from the Health Office.

Private enterprise, too, has been an active though unwitting ally of the Board, in covering during the year many vacant spots with rows of neat and substantial tenement-houses. In this way a great nuisance has been abated, while the supply of convenient and wholesome apartments, for those too poor to meet the rent of an entire house, has been considerably increased.

Small-pox.—The entire winter and spring passed with no case of small-pox reported in my district—a fact the more striking, when the character of much of its population is considered, and it is remembered that the disease, at one time, during this period, threatened to assume an epidemic form in portions of the Metropolitan District.

About the middle of July, however, two cases were reported in a tenement-house in Church Street, and, from that time to the present, thirteen cases have occurred in the same block. The disease generally assumed a mild type, with but little tendency to spread. Two infants, unvaccinated, died; all others recovered. It was introduced into the first house, probably, through the intercourse of one of the tenants with her sister's family in Tallman Street, more than a mile removed, in whose family the disease had existed a short time previous.

Carbolic acid was freely used in each instance for disinfection.

I vaccinated through the block all who needed it or would submit to it, but with no successful results; upon the failure of my first attempt, another was made, but with the same lack of success. The virus was a fresh scab obtained from Dr. Loines, of the Eastern Dispensary, New York, and all due care was exercised in introducing it. The season was in the midst of the summer's heat, and to some cause connected with this may be ascribed, perhaps, the unsatisfactory results. Certainly they were in strong contrast with those obtained in the latter part of September.

At this time two cases of small-pox were reported in Smith Street, near Church Street, in one of a row of tenement-houses. The subjects of the disease were removed to the hospital, and those in the neighborhood needing protection were vaccinated. The virus was on quills obtained from the same source, and introduced in the same way as in the summer; but every arm, excepting one, produced a satisfactory vesicle. The disease in this block seems to have been confined to the house and room where it first occurred. Though I have made frequent inquiries, no other cases have come to my knowledge.

Dr. S. J. HOLLEY submits the following report:

My District embraces the 8th, 10th, and 22d Wards, together with New Utrecht and Coney Island.

My report for 1868 contains a full geographical and physical description of a District embracing more territory and a greater population than any other sanitary District in Kings County. A thorough knowledge of its sanitary condition and needs can only be obtained through a long acquaintance with its inhabitants, and frequent inspections. Of the latter I have made, during the past year, 2,980, with reference principally to defective drainage (one of the most fruitful sources of zymotic disease), also of factories, butcheries, tenements, stables, privies, cesspools, etc.

Drainage.—The Sewer and Water Board, acting upon the suggestion of the Health Board, have caused to be drained several ponds, which were not only dangerous to life, from their great depth of water, but also detrimental to health from the noxious vapors arising from their vast surfaces. Six ponds on the south side of Middle Street, against which orders of the Board still stand, remain undrained and unfilled. By recent act of Legislature, Commissioners were appointed to extend, widen, and rename said Middle Street; by limitation their term of office having expired without definite action, the owners, upon whom said orders were served, now await the final action of the permanent Water and Sewer Board.

There is now in process of construction, through Third Avenue, a sewer which will open the way to a most complete and thorough drainage of my entire District.

In the 10th and 22d Wards a tract embracing upward of 50 acres of useless, marshy, and miasmatic land has been converted into healthful building-lots.

Factories and Butcheries.—These have been so located and conducted as no longer to be a source of danger to the health of the city.

Tenements.—Those tenements, which existed previous to my last annual report, were, by direction of the Board, so altered and repaired as to conform to the "Tenement-house Law." Builders, having been made acquainted with the requirements of said act, have, during the past year, in but few instances, constructed tenements in non-conformity with the act.

A reinspection of old tenements discovered only an occasional necessity for reform.

Stables.—Whenever found, the owners or lessees have been required to construct water-tight manure vaults, in accordance with Section 99 Health Ordinances.

Privies.—When complaints of citizens have not required special attention, I have sought out offensive privies, and, in all cases where sewers have been found, those disgusting and noisome sinks have been abated, and suitable water-closets constructed.

Cesspools, whenever found, have been disinfected, emptied, and filled with fresh earth, except when no sewer was available.

The work of sanitary reform is steadily on the increase; the poor appreciating the efforts of the Board in their behalf, and the large owners of real estate acknowledging the justice of the Board's demands, and, in most cases, conforming without the spur of the attorney.

Dr. W. H. Thayer reports as follows:

The work done in the Third District since the last annual report comprises the abatement of the usual variety of nuisances complained of by citizens or by police, and a pretty general reinspection of tenement-houses. The greater part of the tenement-houses are generally in conformity with the provisions of the "Tenement-house Law." The streets still hold a foremost position, in sanitary consideration, from their filthiness in the vicinity of tenement-houses. This nuisance has, however, been much less serious than in the year 1868, owing to the earlier and more thorough cleansing by the street constructors under the orders of the city government.

Much time and attention have been given to the complaints of the great variety of factories which abound in Brooklyn, and are especially numerous in the 1st, 2d, and 5th Wards. These are iron founderies, lead, linseed-oil and paint works, curriers, breweries, distilleries, sugar-refineries, and slaughter-houses, besides planing-mills and similar establishments.

The ample powers of the Board of Health have given great encouragement to persons inclined to complain of whatever is at all disagreeable in their own vicinity. One of the most arduous duties has been the investigation of the complaints made of many of the man ufacturing establishments, to ascertain, by repeated and careful inquiry and examination, whether the work is, by its nature, inevitably detrimental to the health of the neighborhood, or only by avoidable or careless mismanagement, or simply disagreeable and not at all unwholesome, or only accidentally and temporarily a nuisance.

These investigations have often been as difficult as they were important, because, while the health of the neighborhood was in consideration on the one hand, large pecuniary interests were at stake on the other, and it was obvious that the Board of Health should not be used either for or against the interests of property, but solely in those of health.

In all cases where modifications in the manufacturing processes could be introduced, so as to get rid of any resulting annoyances, manufacturers have been notified of the necessity of making the requisite changes, and have always complied with the requisition. One factory, whose objectionable features were irremediable, was closed by order of the Board.

Another very important matter, in which the influence of the Board of Health has been exerted in this District during the past year, is the control and limitation of small-pox, by the rigid enforcement of those sanitary measures which can be employed with complete success in the absence of a general epidemic influence.

In March four cases occurred in one family in Harper's Court. They were without medical attendance, and were not reported at the Health Office until three or four weeks after their commencement, so that many persons had been exposed to their infection; and, during the months of May and June, ten cases appeared in several of the neighboring streets, within a distance of three blocks; every house was visited where a case was reported, and, in the instance of tenement-houses, those in the immediate neighborhood of the infected house were carefully inspected. All the houses in Harper's Court, and those near it, in Lawrence Place, were inspected.

The object of the visit to the infected family was to enjoin as strict isolation as possible, cleanliness, ventilation, and disinfection, by the free use of carbolic acid during the period of illness, and a thorough purification of the premises afterward; also to vaccinate all who were not already protected in the house and in the neighborhood.

To make sure that these measures had been faithfully carried out, the houses in this vicinity were repeatedly visited at intervals of a week or a fortnight. No case is known to have occurred in this neighborhood since June.

In Tallman Street another small nest of cases was found in June, originating, like those in Harper's Court, in a family who had concealed its existence for some time. This spread to several families in the neighborhood, but was also extinguished before August. In John Street, east from Hudson Avenue, there has been a similar experience; about twelve cases have occurred there in six different tenement-houses, most of which cases are traceable to a wilful neglect of sanitary precautions on the part of the residents. The street has been visited again and again. It is too early to ascertain whether the disease has come to an end in this locality.

Nearly everywhere there has appeared a desire or a willingness to second the efforts of the Board of Health when the necessity of careful sanitary measures was once explained. Where concealment of cases has been employed, it has arisen from some ignorant dread of unpleasant interference on the part of the authorities—a fear which has generally been dissipated by experience.

Dr. J. R. Bird reports as follows:

I have the honor to transmit the following report in reference to work done, that in process, and the general health, and the needs of my District (the 4th), during the past year.

The Fourth District comprises the 9th, 21st, 20th, 11th, and 19th Wards, East New York, and the country towns.

1. As to the principal great nuisances abated: Sunken lots and ponded water, filled with fresh earth in the 9th Ward, Herkimer Street, and Kane Place, 1; Herkimer Street, Ralph, and Fulton Avenues, 8; Buffalo Avenue and Herkimer Street, 4. In the 19th Ward, Walton Street and Harrison Avenue, 1; Whipple Street, near Throop Avenue, 5; Throop Avenue, near Bartlett Street, 1; Thornton Street, near Throop Avenue, 1; Bartlett Street,

near Broadway, 1. In 21st Ward, Walworth Street, near Myrtle Avenue, 1; Fulton Avenue, near Reid, 5; Marion Street, near Patchen Avenue, 8. Total, 36.

In process of abatement, the swamp-lands, bounded by Ellery Street and Myrtle Avenue, Marcy and Nostrand Avenues, 72 lots.

Atlantic Avenue, between Hopkinson and Saratoga Avenues, 5; Atlantic Avenue, corner Ralph Avenue, 2; Atlantic Avenue, between Buffalo and Schenectady, 10; Herkimer Street, east from Kane Place, 5; Reid Avenue, corner De Kalb Avenue, 10. Total, 104.

One acid-factory, Walton Street, near Marcy Avenue, removed; fat-boiling establishment, Dean Street, corner Hunterfly Road; 3 large cow-stables, Gates Avenue, near Stuyvesant, removed; 1 large cow-stable, Throop Avenue, near Ellery Street, in process of abatement.

Brewery, Lafayette, near Throop Avenue, drainage to cesspool; De Kalb Avenue car-stables put in good sanitary condition; 4 slaughter-houses, 2 in 18th Ward, 2 in 9th, altered; 5 dangerous buildings, Navy, near Tillary Street, removed; 1 dangerous building, Portland, corner Park Avenue, raised and made secure; 1 squatter establishment, cows, horses, goats, pigs, etc., on St. Felix Street, corner De Kalb Avenue, removed; while of those in process are the swill and bone boilers, East New York Avenue, near the city line.

The usual number of minor abatements, on complaints of citizens, have been made, as in previous years, as piggeries removed, stables drained, and put in good sanitary condition. Excavations, while building, protected. Areas and cellars protected by iron railings. Lots fenced in. Animals, sick or dangerous, destroyed or removed. Cellars emptied of inhabitants and closed. Chimneys of factories built higher than surrounding buildings. Sewer connections made. Old saturated cesspools filled, and new ones constructed. High grounds graded to street; others ditched for surface drainage. Tenement-houses made to come up to requirements of law.

Efforts have been made looking to the abatement of large and constant sources of disease, as in stagnant depots of water, etc., and sewer connections made wherever possible. There has been less of contagious and miasmatic disease over any other year, and sections, heretofore avoided, having been drained and filled in, are rapidly being built upon and inhabited. Much remains to be done (now in process) in the upper part and middle of 9th Ward, 21st, and 19th; while, in the 11th, a thickly-populated ward, containing many tenement-houses, the need is great for a larger diameter of sewers—the present system being entirely inadequate—the backing up of contents of sewers, during heavy rains, causing much distress and disease. The 20th is a well-drained and healthy ward. The 19th is rapidly improving, from a wider system of sewerage.

East New York has been visited mainly in reference to sunken lots, badly-graded streets, piggeries, and factories. Its great need is a system of grading, paving, and sewerage.

Country towns were visited in regard to dead animals, large collections of manure, and petty nuisances.

But very few of the subjects of complaint and report during the year remain unabated, and these are in process of prosecution by law.

Dr. S. N. Fisk, of the Fifth District, reports as follows:

This District comprises all that part of Brooklyn known as the Eastern District, with the exception of the 19th Ward; but, as Assistant-Sanitary Inspectors Brady and Corey were respectively detailed to the 16th and 14th Wards, these gentlemen will make a detailed report of the same. As, in my last Annual Report, I described the geography, elevation, character of population, etc., of each ward separately, I will not here repeat, but will merely give a general description of the character of work accomplished.

Drainage.—Under this heading I would include the efforts made to institute sewerage in place of the older methods in use, and, in so doing, I found it necessary to cause the cleaning and filling in of many old cesspools and privy-vaults, which were daily giving off their offensive and death-dealing effluvia; also the sewering of districts (by recommendation to the proper authorities) where, from a naturally wet soil, or the improper grading of streets, large collections of ponded water existed, and many cellars were continually flooded or damp. Of the former kind of work much has been done in every portion of the District where practicable, especially in the older portions of the 13th and 15th Wards. Of the latter (district drainage) a great deal has been done by extensive sewerage of the 16th, 17th, and northwesterly portion of the 14th Ward. As a recent instance of special drainage, I would mention the sewerage of Clay Street, from Union Avenue to the East River, to relieve an offensive pond of stagnant water, into which the filth of the Cross-town Railroad stables constantly flowed. The relief of this pond, together with the sewerage of these stables, is undoubtedly of the greatest sanitary value to the vicinity.

Tenement-houses.—The greater number of these is in the 14th and 16th Wards, the rest of the District having comparatively few. Nearly all have been inspected, and the owners obliged to conform to the requirements of the law. A future inspection of the 14th Ward will allow of more satisfactory results, as the sewerage now in progress there will enable many much-needed improvements in drainage to be made. In enforcing this law, the majority of owners complied readily, very few penalties having been inflicted.

Cellars.—There are few of these used as lodging-places in this District, and, such as I have found, I have caused to be vacated with as little distress as possible to the unfortunate tenants.

Stables.—The nuisances generally found here were a neglect to provide proper receptacles for manure, insufficient drainage, and, in cow-stables, in addition to these, an infringement of the code with respect to number. The remedies have been the construction of proper manure-vaults, drainage by sewer connection where possible, and, where not, into the manure-vault, removal of cows in excess of number allowed, and, as in several cases in the 15th Ward, the removal of stables from highly-objectionable locations.

Lots.—Many sunken lots, containing stagnant water, have been either drained by sewerage or filled in, especially in the 15th, 16th, and 17th Wards. Others, which were shedding water upon surrounding premises by reason of too high a grade, have been cut down to a proper grade, or trenched in such manner as to collect surface water and conduct it to street gutter by a curb-drain. Of the latter many have been found in the 13th and 17th Wards. Such vacant lots as were used as depositories for garbage, rubbish, and the like, I have caused to be cleaned and fenced.

Streets.—Before the existence of the new Sewer Board, I followed our former practice of notifying, and, if necessary, of prosecuting, a street-cleaning contractor, where I found neglect or oversight, but I have reported all such cases to that Board since its organization, as its rules are stringent enough to enforce a proper obedience. Where public necessity demanded, I have recommended the grading and paving of certain streets, as in the case of Monroe Street (18th Ward), where, from the peculiar grade, the waste and surface water from a row of tenement and dwelling-houses on the south side of the street was continually flowing down into those on the north side, and forming offensive pools. A resolution was recently passed by the proper Board to grade and pave this street, and it will probably soon be in a good sanitary condition. Where sidewalks were allowed to become dilapidated and dangerous, I have caused the owners to put them in proper condition. Of these latter cases most have occurred in the 13th Ward.

Manufactories.—Many manufactories have been found detrimental to health from the odors and gases given off by the processes carried on within them, as fat-melting, bone-boiling, and soap-making establishments, and acid and manure manufactories. Some of these have been caused so to modify their peculiar processes as to be no longer offensive or detrimental to health, as in the case of two fat-melting establishments in the 17th Ward, two of the same nature and one bone-boiling establishment in Queens County, on Newtown Creek, a sulphuric-acid manufactory (which formerly gave off dense volumes of nitrous acid), and a nitric-acid manufactory in the 17th Ward. Others have been discontinued and closed, as in the case of a soap-making establishment and a manure-manufactory in the 17th Ward. I have also caused several factories, which were obnoxious by reason of their smoke, to carry off the same by means of a proper chimney, the most prominent of which were a glass-house in the 14th Ward, a sash-and-blind factory in the 16th Ward, and a machine-shop in the 13th Ward.

Contagious Diseases.—Of these I have been called most frequently to inspect cases of variola; some I have found it necessary to remove to hospital, and others I have been enabled to isolate at their homes, taking due precautions with regard to vaccination, disinfection, etc. In no instance has the disease become at all extensive, excepting in a tenement-row in the 14th Ward, where I was obliged to remove five cases, the contagion having extended somewhat before detection. In respect to cases of typhoid fever, I have seldom been obliged to interfere, further than to attend to the sanitary condition of the surroundings, cleanliness, disinfection, etc.

In conclusion, I would remark that the ready compliance with which all necessary orders have been met, in the great majority of cases, has been gratifying to observe, and argues a proper appreciation of the intention, efforts, and sincerity of the Metropolitan Board of Health, and its subordinate officers.

Dr. Charles Corey, Assistant-Sanitary Inspector of the Sixth District, reports as follows:

I entered on my duties upon the 1st of April, and, in accordance with instructions from the Assistant-Sanitary Superintendent, began a methodical inspection of the tenement-houses of the 14th and 20th Wards, with a view to their registration. This special work was continued throughout the greater part of the month, when it was suspended, as it seemed, for a time, to be of less practical importance than more general sanitary work.

During the six months included in this report, 296 tenement-houses have been inspected; of this number 94 were found to be in a satisfactory condition, while 282 were more or less deficient, either in construction or cleanliness, against which the usual complaints were made. Of this number, 190 have already been made to conform to the requirements of the "Tenement-house Act," while 12 complaints have been referred to the Assistant Attorney of the Board for prosecution.

During the same time, 541 nuisances complained of by citizens, by the sanitary police, or discovered in the course of a "house-to-house" inspection. Of these, 27 were cases for special complaint, 80 were complaints without just cause, 8 were cases of contagious disease, while 426 were violations of the Code of Sanitary Ordinances. Of this number, 332 have been properly abated, while 94 remain unabated or in process of abatement.

Though nothing in itself of striking importance appears in the above summary, it is believed that, in the aggregate, satisfactory results have been attained. Numerous tenement-houses, that were found in an extremely bad hygienic condition, have been renovated and made comparatively desirable places of abode; damp basements and cellars have been vacated, a large number of privy-vaults have been disinfected and cleaned, and when practicable abolished, and their places supplied with others, with approved sewer connections—yards and alleys cleaned, piggeries abolished, sunken and vacant lots filled and properly enclosed, instances of imperfect sewerage, drainage, or grading, remedied, and various other nuisances abated, that in one way or another tended to contaminate the surrounding atmosphere, and so to impair the public health.

Tenement-Houses, Inspections of		669
" Reinspections of	373	
" Found in good order	94	
" Complained of	202—	669
" Made to comply with law	190	
" Complaints referred to Assistant Attorney for prosecution	12—	202
Nuisances, Inspections of		1,222
" Reinspections of	681	
" No cause of complaint found	80	
" Special Complaints	27	
" Contagious Diseases	8	
" Violations of Code of Sanitary Ordinances	426—	1,222
" Abated	332	
" In process of abatement	94—	426
Total number of Inspections		1,891

Dr. R. M. Wyckoff reports as follows:

The section of the city assigned to me is embraced in the 7th and 19th Wards, a somewhat compact district lying in the northern and central part of the city. In its general outline the surface is broken or undulating, in this respect partaking of the characteristics that mark the topography of this region. The elevated portions or ridges furnish elegible sites for residences; their sanitary conditions are good, and for the most part have been long built up and occupied by the wealthier classes of our community. The lower, more unhealthful, and cheaper portions, furnish plots for the erection of tenements and small dwellings. In the 7th Ward is the region known as "Jackson's Hollow," occupied by a miscellaneous collection of squatters' huts, piggeries, and stables. In the 19th Ward lies the marshy tract formerly called the Wallabout Flats, of which the better portion has been chosen for the erection of a large number of tenement-houses during the past two years. These are occupied by a population almost wholly foreign. On this tract and along the margin of the East River are found the greater number of the distilleries, tanneries, sugar-refineries, and the like, that contaminate the air with organic matters. The principal part of the built-up area of the district is occupied by brick or frame dwellings suitable for a single family. Hence, as a whole, the district may be said to be in a transition, or formative, stage, and its sanitary vices or defects are those pertaining to a new rather than an old section.

Drainage.—During the past summer the Sewer Commissioners have been very active in advancing the status of the system of sewers. Formerly the sewerage has been deficient by reason of the small size and small number of the sewers laid. But the rapid increase of population and the enhanced value of property have demanded the extension of sewer privileges. Probably not less than two and a half miles of sewers have been constructed, or are in process of building. This activity has been especially welcome, in a sanitary point of view, in those low-lying tracts where, by the filling in of the streets, the natural drainage has been obstructed, and where pools of stagnant water have been the inevitable result. In the case of many of these sunken lots, the owners have been required to grade or drain by sewer connection. It has been my aim to require such connections to be made from all classes of buildings, where it could be done, but especially from tenements, liquor-saloons, and factories.

Tenement-houses.—The houses of this class that I have inspected have been found to be small in size, not many being more than three stories high above the basement. They accommodate on an average from four to five families each. The better portion of these have been built with some reference to the privacy and comfort of the tenant families. Their sanitary condition is for the most part good, and they are not overcrowded. They are generally kept clean, especially those in the 19th Ward, occupied by a German population. There are several of another kind which it is almost impossible to keep in a habitable condition. This applies particularly to those houses whose location is unfavorable, or whose construction is such as to attract only the poorest of the poor. The builders of these houses are becoming familiar with the requirements of the "Tenement-house Law," and I frequently find that they spontaneously comply with them in every essential particular. They often make provisions for the introduction of water and for sewer connection before the main pipes are laid in the street. There is one difficulty with the class of population filling these houses, arising from the fact that they fail to appreciate the pernicious effects of decaying organic matters. Garbage and every description of refuse matter are thrown on vacant lots and into the streets. Where there is a sewer in the street, liquid filth runs into the culverts, and there stagnates and putrefies, until a shower of rain comes to flush them. Otherwise they are not flushed, as the house drainage runs directly into the sewer. This nuisance would be in part, at least, abated if the garbage carts were more regular and frequent in their visits, for then receptacles for garbage and ashes would be more generally employed.

The total number of tenement-houses inspected was 221, completing the survey of the two wards of the district. Against 105 of these, complaints of the infraction of the Law of

1867 were issued with this result, namely, 78 orders were complied with, and the remainder, 27, are either in process, or are deferred until the newly-constructed sewers are accepted by the authorities of the city. In the summary heretofore presented, 200 houses were reported, with a detailed description of their sanitary condition at the time of the first inspection. Since then many improvements have been effected, chiefly in respect of ventilation, drainage, and fire-escapes.

Enforcement of the Sanitary Code.—The violation of certain of the regulations of the code are constantly occurring. These result quite as often from neglect and ignorance as from malice, or disregard of law; hence it has ordinarily been found that the customary notice has promptly insured the abatement of the nuisance. In the greater proportion of cases the requirements of the preliminary notice have been found complied with at the second inspection. In some an extension of time has been granted where there was manifested a willingness to comply, and the public health would not be endangered by such a course. In a small number of cases, where there has been a continued disregard of the ordinances of the Board, it has been necessary to compel obedience by arrest. The sections of the code that I have found most frequently violated are those relating to inadequate drainage, filthy privies and cesspools, stables and manure-vaults, vacant lots, and filthy streets. Several tanneries, refineries, and other factories, the emanations from which have been complained of by citizens, have been examined, and steps taken to remove the cause of offence.

Dr. Brady, Assistant-Sanitary Inspector, of the Eighth District, submits the following report:

Upon my appointment, as Assistant-Sanitary Inspector, I was assigned to duty in the 16th Ward, Eastern District. This is the German ward of the city, and is perhaps the most populous. The land lies low, having in some of the marshy places a rise and fall of the tide. The houses are built closely together, generally two on a lot, front and rear, and so arranged in the interior as to contain upward of three families. The inmates, as a class, are neat and clean. This has always been one of the most unhealthy wards of the city; the death-rate very high, particularly among the children. The causes producing such a high rate of mortality are such as exist in any place where nearly all sanitary reforms have been neglected. The crowding together of such a large number of people within confined limits, unwholesome food and drink, total neglect of proper ventilation, the want of sufficient sewerage, and the large ponds of filthy, greenish stagnant water, dotting here and there the upper part of the district, have all contributed to keep the percentage of death high.

The chief duty allotted to me was to make a rigid sanitary survey of the tenement-houses, correct all existing evils, and especially to look after the proper ventilation and sewerage of such as were found deficient.

The majority of the tenements have been thoroughly inspected by me, and the "Tenement-house Act" strictly enforced in every case, except as regards sewerage. This spring the Water Board completed the ward sewer, and hopes were entertained by the Health Board that, through the enforcement of necessary drainage, the increasing mortality would be materially reduced. I am sorry to say that, by experience, it has been found impracticable, and even dangerous to the health of the ward, to make sewer connections. During the dry season about one-third of the tenement-houses were connected with the main sewer; but the first heavy rain that fell forced the filthy sewerage back into the streets, through the manholes, into cellars, basements, yards, etc., rendering some of the houses not habitable for the time being, destroying a large amount of property, and, instead of proving a benefit to the people, such connections have added more to the mortality, thus defeating the aims of the Health authorities.

The committee, appointed at a public meeting of the property-owners, called the attention of the Water Commissioners to the existing evil, and, on an examination by their engineer, it was found that, in some places, the main sewer was completely blocked by accumulations of sand and refuse material that had washed in from the streets.

The sewers have been thoroughly cleaned and flushed, and are now said to be in working order.

My impression is that this sewer will never be found adequate to fulfil the proper drainage of the ward, the natural grade of the ward being so low that each spring-tide will force the sewer contents back into the streets by the back flow. No connections are now ordered, except in unavoidable cases.

Besides the inspection of the tenement-houses, many violations of sanitary rules have been corrected, and every thing done by the Inspector that lay in his power to improve the health of the people.

Numbers of the ponds have been drained, but, in some cases where the owner's name could not be discovered, the complaint has been forwarded for the action of the Attorney of the Board. The streets have been in a very filthy condition; some have been cleaned, and others, at the present writing, are awaiting the action of the Water Commissioners, complaints having been forwarded to them. Stables have been drained, manure-vaults built, cesspools emptied, and all violations of the code corrected wherever found. Some few cases of typhoid fever have occurred, and isolated cases of small-pox have been visited; when necessary, the infected have been removed to the hospital, the places disinfected, and the unvaccinated vaccinated.

In all my dealings with the people of this ward, I have ever found them ready and willing to carry out any sanitary measures proposed, and my thanks are due to them, without a single exception, for the kind manner in which I have been received as an agent of the Board; they deserve a healthier ward.

VITAL STATISTICS.

THE mortality record of the year presents that felicitous lack of interest to the public which attends unusual healthfulness. No epidemic of magnitude has set its mark upon it; the ordinary miasmatic diseases have been no more prevalent or fatal than usual; the temperate character of the summer rendered cholera infantum and diarrhœal diseases less destructive of life, and even winter has been less formidable than usual to the destitute. Although the causes which affect the health of a great city are exceedingly complex, so that it is impossible to assign to each its share in the production of disease, it may fairly be presumed that the steady work of the Board of Health in ventilating and renovating tenement-houses, and in suppressing thousands of nuisances, has exerted a decided influence in lowering the death-rate. The most prominent fact which is presented by the records of the year is the influence of a temperate summer. In no year of the Board's existence has the mortality for the months of July, August, and September, been so light as for the third quarter of the past year. But tenement-houses and all other dwellings have a climate and atmosphere of their own, and no meteoric influence, however favorable, will serve to arrest the progress of contagious disease among a crowded population; vaccination, isolation, and disinfection, are the only reliable barriers against small-pox; ventilation and disinfection the only sure preventives of typhus; the removal of the causes in dampness and foul air, the best protection against consumption and against virulence and fatality in all diseases, particularly in those of infancy. What the death-rate might have been without the intervention of the Board of Health, it is impossible to compute, but this much is certain: the atmospheric miasmata of our city are harmless in comparison with the mephitic medium which is breathed in badly-ventilated and crowded tenements. The city government is responsible for the city's atmosphere as affected by streets and sewers; but ignorance respecting the need of pure air is a mark of individual and personal degradation, for which no other remedy exists than the teaching of

Sanitary Inspectors, armed with power to compel attention and obedience, and a lessened death-rate must be a sure test and proof of an Inspector's fidelity to duty. The 14th Ward is the most crowded with tenement-houses, and received during the past summer the attention of a conscientious and laborious Inspector. In that ward the mortality for the fourth quarter of the past year was only 120, while for the corresponding period of 1867 and 1868, and with a much smaller population, it was 138 and 123. In the 12th Ward for the last quarter of 1869 the mortality was only 96, while in 1867 and 1868 it was 115 and 110. In the 7th Ward it was but 74, in the previous years 80 in each. It is remarkable that in the 3d Ward, which is the healthiest ward of the city, and receives almost no attention from the Board of Health, the deaths for the fourth quarter of the past year were 32, or double the number for the same quarter of 1868. Likewise in the 20th, which approaches the 3d in healthfulness, the deaths for the fourth quarter of the past year were 83, to 78 and 76 in the two preceding years, respectively. These facts go far toward justifying the assertion that the work of the Board has been made manifest in a lessened mortality.

The mortality of the entire city for the years 1867, 1868, and 1869 (each year of the Bureau, ending with the 30th of September), was 8,236, 8,992, and 8,663; for the calendar year, 8,389, 8,750, and 8,759.

Wards forming separate and marked divisions of the great mass of the city's population, it will be interesting to give the mortality in each, and the present is a favorable opportunity for comparing the ward mortality for different periods since the establishment of the Metropolitan Board of Health. With the close of 1869, terminates a period of 45 months, or of fifteen quarters, and quarterly periods will be most convenient for ready comparison. The following table presents the mortality of each ward for each successive quarter since the spring of 1866. The 21st and 22d Wards belong to the past year only, the 21st taken mainly from the 9th, and the 22d from the 8th Ward of previous years.

Total Mortality for Quarter ending

WARDS.	1866.			1867.				1868.				1869.				Population at last Census of 1865.
	June 30.	Sept. 30.	Dec. 31.	March 31.	June 30.	Sept. 30.	Dec. 31.	March 31.	June 30.	Sept. 30.	Dec. 31.	March 31.	June 30.	Sept. 30.	Dec. 31.	
First	41	48	31	19	32	47	39	30	38	50	20	37	32	16	23	6,128
Second	60	95	72	63	43	95	50	58	58	81	50	42	72	75	57	8,760
Third	28	63	34	53	28	35	31	39	40	48	16	48	41	37	32	8,890
Fourth	73	99	59	67	63	76	53	55	72	94	43	62	49	72	58	11,506
Fifth	107	231	132	137	126	186	123	101	93	209	103	126	146	171	124	17,820
Sixth	140	302	157	147	141	255	186	172	172	285	151	152	195	207	170	26,407
Seventh	62	115	91	95	70	126	80	69	72	142	80	103	89	108	74	15,968
Eighth	65	173	75	81	54	124	72	49	57	140	68	60	56	104	50	9,829
Ninth	130	294	161	150	131	333	182	150	151	308	164	91	83	143	63	23,443
Tenth	141	292	162	190	127	235	158	165	146	303	180	162	147	227	137	28,668
Eleventh	127	221	129	144	114	183	124	148	105	116	96	140	124	167	124	18,242
Twelfth	92	504	78	94	97	188	115	85	85	234	110	86	116	155	96	13,085
Thirteenth	63	122	74	100	79	134	89	84	96	143	78	110	75	107	76	17,791
Fourteenth	97	189	118	117	93	172	138	101	109	206	123	131	113	145	120	15,425
Fifteenth	49	87	69	59	62	108	86	80	50	121	79	69	83	137	73	11,449
Sixteenth	169	306	152	135	149	332	255	228	183	434	155	157	178	389	186	24,379
Seventeenth	44	95	87	65	41	93	47	56	56	108	64	81	72	139	77	10,234
Eighteenth	27	52	40	25	31	67	55	42	45	108	49	38	36	102	48	6,053
Nineteenth	41	69	59	55	42	68	54	43	53	128	68	61	59	112	63	8,055
Twentieth	73	101	82	66	41	91	78	100	62	121	76	90	86	90	83	13,980
Twenty-first	....	....	....	....	....	....	....	....	....	....	....	101	100	158	110	To 9th Ward
Twenty-second	....	....	....	....	....	....	....	....	....	....	....	49	30	51	30	To 8th Ward

The 8,759 deaths of the past year, classified according to causation, are thus divided:

Zymotic Diseases	2,785
Constitutional Diseases	2,128
Local Diseases	2,892
Developmental Diseases	704
Violent Deaths	250
Total	8,759

Zymotic Diseases.—This class of diseases was less destructive of life than in previous years. Scarlatina (348) was not so wide-spread; and cholera infantum (812) was far less fatal. The incubation of the present epidemic of small-pox is seen in the twenty-two deaths from this cause, while in no year since 1865 have there been more than two deaths.

The mortality from epidemic and contagious diseases for the entire period of the Board's existence is seen in the following table, which gives the zymotic diseases in quarterly summaries from April 1, 1866, to January 1, 1870:

QUARTER ENDING	Small-pox.	Measles.	Scarlatina.	Diphtheria.	Croup.	Whooping-Cough.	Typhus Fever.	Typhoid Fever.	Cholera.	Cholera Infantum.	Other Diarrhœal Diseases.	Other Zymotic Diseases.	Total Zymotic Diseases.	Total from all causes.
1866.														
June 30....	1	37	55	41	24	7	8	43	......	33	38	33	320	1,629
Sept. 30....	....	7	32	33	16	14	2	61	517	717	336	163	1,898	3,458
Dec. 29.....	....	2	69	35	53	8	9	68	7	65	71	54	441	1,862
	1	46	156	109	93	29	19	172	524	815	445	250	2,659	6,949
1867.														
March 30...	....	30	104	28	57	28	2	41	......	5	30	58	383	1,862
June 29....	....	76	112	16	35	18	5	13	......	22	38	23	358	1,564
Sept. 28....	....	45	93	18	18	55	2	25	......	728	266	70	1,320	2,948
Dec. 31.....	....	57	95	42	65	36	9	32	......	30	73	40	479	2,015
	—	208	404	104	175	137	18	111	—	785	407	191	2,540	8,289
1868.														
March 31...	1	22	230	45	49	29	3	21	......	1	15	53	469	1,855
June 30.....	1	5	133	22	26	29	2	10	......	26	27	49	330	1,743
Sept. 30....	....	3	39	23	9	75	8	37	......	1,084	419	66	1,763	3,379
Dec. 31.....	....	2	87	47	42	58	7	34	......	33	86	53	449	1,773
	2	32	489	137	126	191	20	102	—	1,144	547	221	3,011	8,750
1869.														
April 3.....	....	15	153	57	55	71	3	15	......	2	30	42	457	1,995
July 3......	4	137	104	29	35	40	2	21	......	99	55	45	592	1,981
Oct. 2......	6	87	44	24	30	64	5	16	......	680	290	26	1,301	2,911
Dec. 31.....	12	20	48	31	55	18	1	45	......	31	57	31	365	1,872
	22	259	349	141	175	193	11	97	—	812	432	144	2,715	8,759

Among *dietic* affections only 45 were returned as deaths from alcohol. This is an insignificant fraction of the real ravages of this steady pestilence. In the first place, physicians are unwilling, for the sake of the family, or from motives of personal regard, to place on record the fact that their patients have died so miserably, and the death is attributed to congestion of the brain, heart-disease, etc. Again, the deaths from cirrhosis or hob-nailed liver, from Bright's disease or other affections of the kidneys, from gastritis, and from insanity, which are due to the long abuse of alcoholic stimulants, are not reported differently from the same affections from more innocent causes, so that it is impossible to compute from the mortality record the proportion of deaths due to the abuse of alcoholic stimulants, and a question of the first importance is left unanswered. Such facts as these abate much of the interest which the study of the death-record would otherwise excite. The same may be said of the returns of death from syphilitic affections, where similar causes vitiate the returns.

The deaths from *consumption* were, for the past year, 1,136; for 1867, 1,161; for 1868, 1,098, a slight increase on the previous year, but less than for 1867. Every young person, just entering on manhood or womanhood, has as much reason to fear consumption at all seasons as every one has to fear cholera during an epidemic. In other words, this disease is so fatal to the period of puberty, and early manhood and womanhood, that it is as if these ages were in the midst of a constant epidemic of fatal disease, and hence the causes which generate the disease ought to be thoroughly understood, so as to permit them, if possible, to be removed or avoided. Dampness and cold are the chief causes, but all sources of bodily or mental depression lend their aid in assuring the fatal result.

The large number of deaths from marasmus (454), which is held as equivalent to tabes mesenterica on the death-returns, includes not only the deaths from tuberculization of the mesenteric glands, but all deaths from wasting disease which could not be assigned to more definite causes.

Of *diseases of the nervous system*, convulsions (481) are given as the cause of the largest number of deaths. The nervous system of infants is so sensitive to the action of all morbid causes, that convulsions are liable to attend almost all diseases of infancy, and to mark the approach to a fatal termination; hence this record represents those cases, dying of convulsions, in which the disease which gave rise to them was not recognized or not recognizable.

Heart-diseases are given as the cause of 259 deaths.

Of *pulmonary* affections, pneumonia caused 577, and the closely-allied congestion of the lungs 146 deaths.

The highest number of deaths recorded under diseases of the *digestive system* is 98 from enteritis; the deaths from convulsions under diseases of the nervous system were for the most part doubtless from indigestion, enteritis, gastritis, and colic in infants, for it is to the digestive system that by far the larger proportion of the diseases of infancy is to be traced. Incapacity on the part of mothers to nourish their offspring requires the latter to be fed on all manner of food utterly unsuited to the purpose. Cows' milk is either too watery to nourish, or forms a too solid curd for any other than the most vigorous digestive apparatus. Flying from these and from swill-fed horrors, mothers resort to the host of farinaceous preparations, barley, oat-meal, farina, arrow-root, etc., which are about as well suited to a human being as herbaceous food to the carnivora. Hence digestive disorders are the chief source of infant mortality, although the fact does not appear on the mortuary record.

Bright's disease was the cause of 136 deaths.

Of deaths from *parturition* there were 55.

Of deaths from *violence*, 33 were from burns and scalds, and 43 from drowning. Every effort has been made to avert the terrible dangers of using explosive oils for purposes of illumination, and with a most gratifying result, for the accidents from this source are by no means as numerous as formerly. The number of deaths reported from drowning is mainly due to bodies washed dead upon our shores, at certain localities where the tide is sure to carry them. They are not, therefore, chiefly deaths from among our own population, but rescue-apparatus ought to be provided wherever experience has shown that its aid is likely to be required.

The total number of violent deaths was, for the past year, 250; for 1867, 259; and for 1868, 274. Of these, the suicides for the past year were 19; for 1867, 27; and for 1868, 27.

The number of *births* reported (5,038) is slightly greater than in preceding years.

The *marriage* record has manifested a most decided improvement. There were reported the marriages of 4,852 persons for the past year, while, for the previous year, the number was only 2,798.

That the work of the Board of Health has therefore been one of growing and cumulative usefulness and importance, is shown in the records of the Bureau of Vital Statistics, as well as in those of the active intervention of the Board among contagious diseases, nuisances, and unwholesome abodes. From the point now reached by such stress of watchfulness and activity, there should be no retrogradation. Progress in sanitary science and sanitary government is among the most urgent demands of our civilization.

Yours respectfully,

R. C. STILES,

Assistant-Sanitary Superintendent.

"C."

REPORT ON VITAL STATISTICS.

To the Secretary of the Metropolitan Board of Health:

The vital statistics of New York and Brooklyn for 1869, as in the preceding three years, are justly regarded as constituting a portion of the sanitary records of the year. We do not overlook the importance of these statistics in regard to social and civil interests, but, as sanitary officers, we devote the first analysis and study of them to the elucidation of questions relating to the health and physical welfare of the people.

The records of death are complete, for no concealment concerning this last event in man's history is practicable, under the laws, without misdemeanor. But, in regard to the records of marriage and birth, statistical completeness is impossible under the voluntary system of certification that prevails in the State of New York. The increasing degree of completeness, which is shown in the register clerk's report for the present year, indicates the growth of popular intelligence concerning the uses of the public registration of births and marriages. There has been, for the past two years, also, a greatly-increased degree of accuracy in the medical returns upon the causes of death. This circumstance enhances the practical usefulness of the mortuary records.

The total number of deaths in the city of New York, during the twelve months ending October 1, 1869, was 24,601. The total number in Brooklyn was 8,667. The total number of persons whose marriage has been duly authenticated and recorded during the year amounts to 15,428 in New York, and 4,852 in Brooklyn; while the number of births recorded in the same period was 14,078 in the former, and 5,138 in the latter city.

The causes and circumstances of death are studied to ascertain the bearing and results of preventable diseases or other removable evils; and, were the records of marriage and birth sufficiently complete, they would, like the records of mortality, be especially useful in aiding to unfold comprehensive principles that underlie those prosperous and healthful conditions of the social state and the homes of the people, without which all plans and efforts to promote the public health would ultimately become unmeaning and vain.

The marriage of 15,428 persons in the city of New York during the year would properly be regarded as evidence of prosperity in the industrial and commercial pursuits of the people; for it shows a marriage-rate equal to 15,428 in 1,000,000, a million being the present estimate for the total population of the city. The actual rate, had all the marriages been reported, would be not less than 20 in 1,000. This, like the rate of mortality in the city, gives certain statistical elements for estimating the general prosperity and public health, and the gains to city population.

During the past year the causes and local circumstances of mortality have continued to receive the same close attention as in the three previous years of the Board's administration. The records of every week, month, and quarter, in the year have been studied, and the register clerk has kept up the account with human life, and its losses in the tenement-houses of the city. These records have been carefully collated and compared in every street, avenue, and ward, and, in particular blocks and groups of dwellings; and the results of this unceasing inquiry and study have been made directly available for guidance and aid in sanitary administration.

The vital statistics of the year will, as in previous years, be here grouped in the subdivisions of quarters. The Brooklyn records will be presented complete by Assistant-Sanitary Superintendent Dr. R. C. Stiles; the statistics of birth and marriage in New York, by Mr. Bowne, the register clerk; and the statistics of mortality in tenement-houses, by Mr. Norris R. Norton, the chief clerk in the office of the Sanitary Superintendent. These sections constitute one report, upon the same general plan as in previous years.

STATE OF THE PUBLIC HEALTH AT THE END OF THE YEAR 1868.

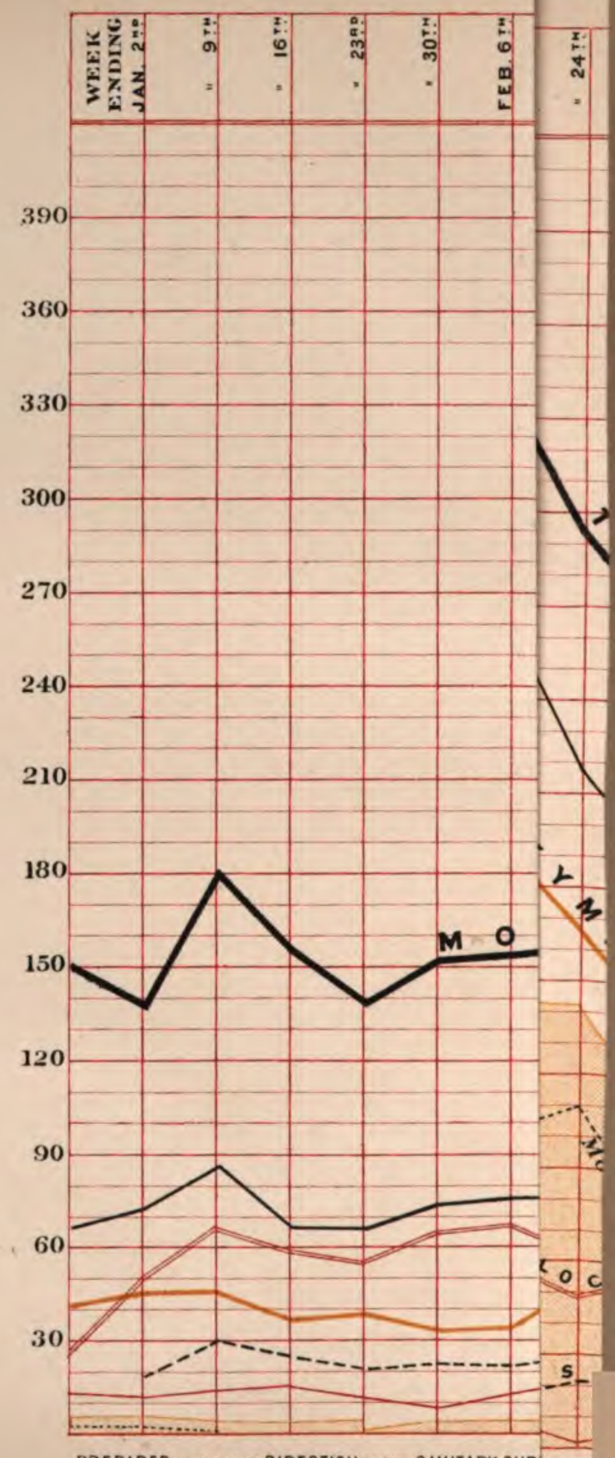
The months of November and December, 1868, were marked by the lowest death-rate that had been experienced in New York during the present generation. The total number of deaths, in the thirteen weeks ending December 31st, was 4,755. And in Brooklyn the total amounted to only 1,773. These rates of mortality in the quarter were scarcely equal to 20 deaths in 1,000 yearly. The autumn was mild, food supplies were abundant, and no epidemics existed in either city, and the prevalence of measles and scarlatina subsided to an unusual degree. The only contagion that manifested any signs of increase was small-pox; six deaths were caused by it during the month of December, whereas it had caused only eighteen deaths in the previous eleven months. Emigration from German and Scandinavian states was pouring vast numbers of persons into temporary lodgings in New York, but no direct connection between them and the individual cases of small-pox in the city was traced. With the single exception of these cases of small-pox, the winter opened with very favorable prospects of healthfulness. The tenement-houses, and every class of domiciles, except the strictly-private dwellings in the city, were more excessively overcrowded than ever before. Startling facts regarding the amount of overcrowding in the common tenements were brought to light during the subsequent months in the sanitary survey of tenement-houses. What the actual population of the city amounted to at the beginning of the year 1869 could not be known except by means of an accurate census; but the facts that have been acquired in the course of sanitary inspection warrant the conclusion that the population of New York was about 1,000,000, and that of Brooklyn was about 370,000 at the beginning of the year. These estimations (1,000,000 for New York, and 370,000 for Brooklyn) will be taken as the basis for statements concerning death-rates in the year 1869.

DEATHS FROM ZYMOTIC DISEASES.

NEW YORK.—Deaths from Small-Pox, Measles, Scarlatina, Diphtheria, Whooping-Cough, Typhoid Fever, Typhus Fever, Cholera, Cholera Infantum, Diarrhœal Maladies, and other Zymotic Diseases. Registered in the Winter Quarter (13 weeks) ending Saturday, April 3, 1869.

WARDS.	Small-pox.	Measles.	Scarlatina.	Diphtheria.	Croup.	Whooping-Cough.	Typhus Fever.	Typhoid Fever.	Cholera.	Cholera Infantum.	Cholera Morbus; other Diarrhœal Diseases.	Other Zymotic Diseases.	Total Deaths from Zymotic Diseases.	Deaths by Accident or Negligence. (*Coroners' Inquests.*)	Total Deaths from all Causes.	Total Population (in Wards), Census of 1865.	Percentage of Zymotic Deaths on Total Mortality.	Deaths per 1,000 annually of the Population from Zymotic Causes.	Deaths per 1,000 annually of the Population from all Causes.	REMARKS.
First	....	....	1	1	3	2	1	1	....	....	......	4	13	5	94	9,852	13.83	5.28	38.17 *a*	(*a*) Castle Garden and Emigrant Depot, 2.
Second	....	....	....	....	....	....	1	....	....	....	......	1	2	1	6	1,194	33.33	6.70	20.10	
Third	....	....	....	....	....	....	....	....	....	....	......	1	1	3	18	3,367	5.55	1.19	21.38	
Fourth	....	....	5	1	4	2	....	5	....	1	2	10	30	3	153	17,352	19.61	6.92	35.27	
Fifth	....	....	1	1	7	1	1	2	....	....	1	10	24	21	148	18,205	16,22	5.27	32,52 *b*	(*b*) New York Hospital, 49.
Sixth	....	....	5	2	3	3	....	3	....	....	1	6	23	4	162	19,754	14.20	4.66	32.80 *c*	(*c*) City Prison, 2.
Seventh	....	6	13	8	5	6	2	3	....	....	4	6	53	9	272	36,962	19.48	5.73	29.44	
Eighth	1	1	13	3	7	8	1	3	....	....	5	13	55	5	267	30,098	20.60	7.31	35.48	
Ninth	....	....	25	4	4	4	....	....	....	....	3	11	51	10	268	38,504	19.03	5.30	27.84 *d*	(*d*) St. Vincent's Hospital, 34.
Tenth	1	1	11	5	11	2	1	1	....	....	2	6	41	8	210	31,537	19.52	5.20	26.64	
Eleventh	2	16	31	7	18	4	2	4	....	....	8	11	103	6	401	58,953	25.69	6.99	27.21 *e*	(*e*) St. Francis's Hospital, 16.
Twelfth	....	28	5	7	5	4	7	40	....	....	113	67	276	6	563	28,259	49.02	39.07	79.69 *f*	(*f*) Ward's Island, 192; Randall's Island, 5; House of Refuge, 2; Bloomingdale Lunatic Asylum, 6; House of Good Shepherd, 2; Colored Orphan Asylum, 2; Infants' Hospital, 209.
Thirteenth	....	5	7	5	7	1	....	....	....	....	3	2	30	3	188	26,388	15.96	4.55	28.50	
Fourteenth	....	....	7	1	8	1	....	1	....	....	3	4	25	4	157	23,382	15.92	4.28	26.86 *g*	(*g*) R. C. Orphan Asylum, 1.
Fifteenth	....	....	4	2	5	1	....	3	....	....	4	8	27	6	133	25,572	20.30	4.22	20.80	
Sixteenth	....	....	13	3	5	4	....	1	....	1	2	13	42	3	236	41,972	17.80	4.01	22.49 *h*	(*h*) St. Joseph's Hospital, 3.
Seventeenth	1	12	43	15	24	6	11	9	....	1	10	24	156	9	582	79,563	26.80	7.84	29.26 *i*	(*i*) Eye Infirmary, 1.
Eighteenth	....	4	11	5	19	9	1	6	....	....	2	9	66	5	305	47,613	21.60	5.55	25.62	
Nineteenth	8	6	16	3	6	5	3	5	....	1	14	25	92	14	542	39,945	16.97	9.24	54.28 *j*	(*j*) City Lunatic Asylum, 30; Almshouse, 27; Penitentiary, 2; Small-pox, 8; Charity Hospital, 111; Epileptic and Paralytic Hospital, 6; Woman's Hospital, 3; Colored Home Hospital, 26; Nursery and Child's Hospital, 46; St. Luke's Hospital, 24; R. C. Orphan Asylum, 1.
Twentieth	....	2	30	5	6	11	1	6	....	....	4	13	78	11	426	61,884	18.31	5.04	27.54 *k*	(*k*) Mount Sinai Hospital, 14.
Twenty-first	2	2	16	4	10	6	1	5	....	....	6	28	80	29	468	38,669	17.09	8.28	48.35 *l*	(*l*) Bellevue Hospital, 188; Home of the Friendless, 4.
Twenty-second	1	....	42	5	6	5	....	4	....	....	5	10	78	10	320	47,361	24.37	6.59	27.03	
Totals	16	83	299	87	163	85	83	102	....	4	192	282	1,346	175	5,919	726,386	22.74	7.41	32.58	Total in Public Institutions, 1,016.

THE COURSE RO



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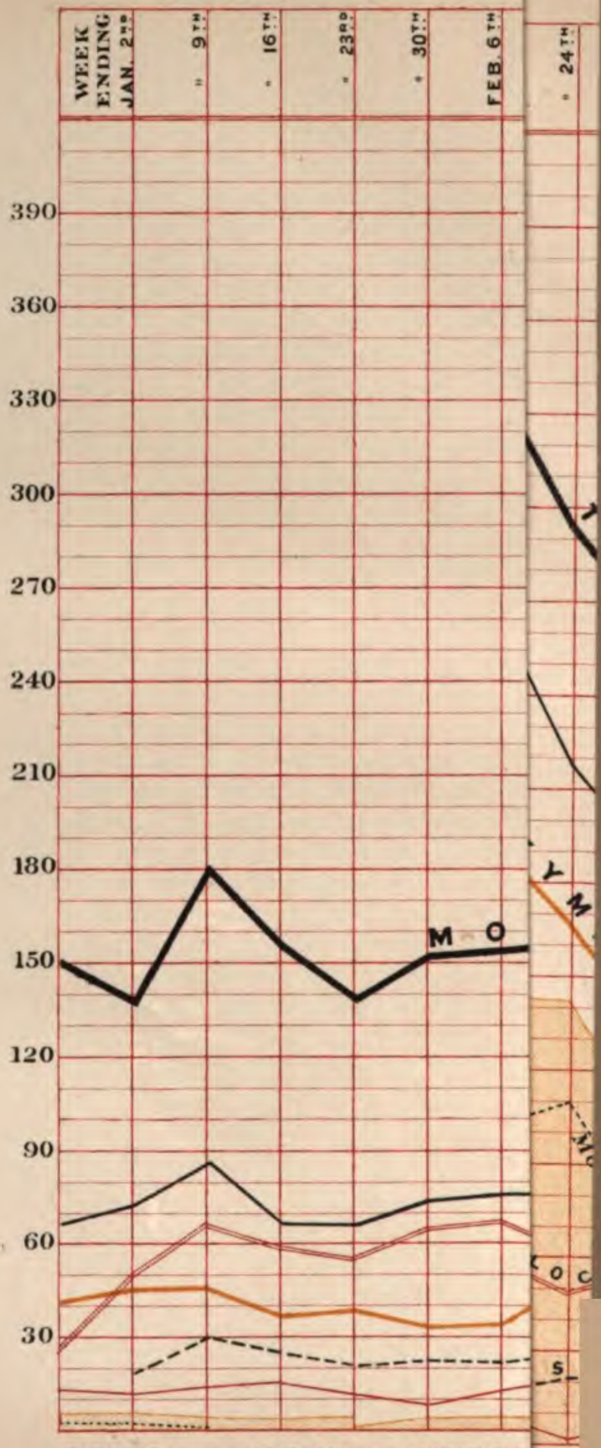

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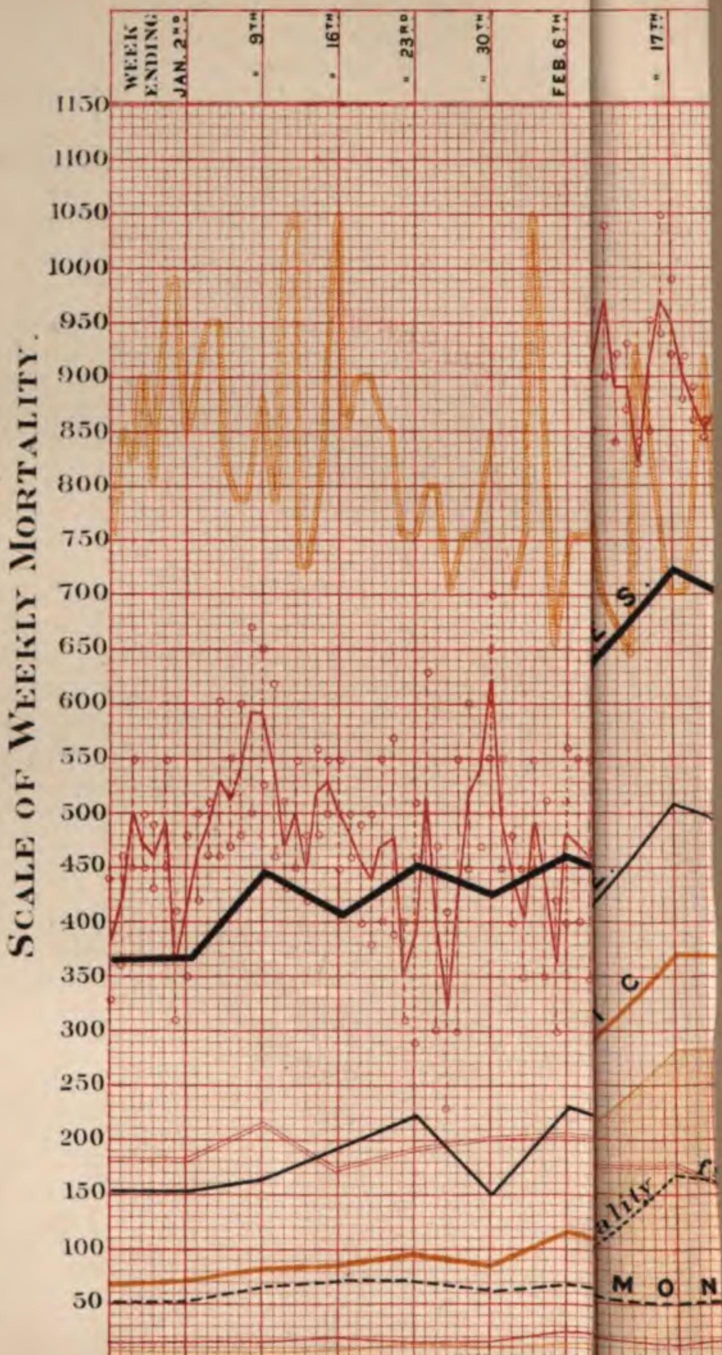

Prepared under Direction of the Sanitary Superintendent by **The Tint**

Sexes, Nativities, Ages, and Percentages, at each period.

MONTHS.	MALES.	FEMALES.	TOTAL.	UNITED STATES.	FOREIGN.
January	925	809	1,734	1,094	640
February	961	840	1,801	1,157	644
March	1,293	1,091	2,384	1,594	790
Total	3,179	2,740	5,919	3,845	2,074

MONTHS.	Under 1 year of age.		1-2.		2-3.		3-4.		4-5.		5-10.		10-15.		15-20.		20-25.		25-30.		30-35.		35-40.		40-45.		45-50.	
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
January	246	195	74	73	61	44	26	24	17	18	41	35	10	9	15	18	38	37	44	48	47	42	52	55	53	29	52	32
February	268	213	97	96	58	43	19	37	25	27	51	33	12	15	17	16	33	45	56	42	46	48	56	46	46	43	40	23
March	372	280	131	104	54	64	48	31	29	26	60	60	18	13	25	26	39	63	62	52	63	50	55	57	63	43	53	39
Total	886	688	302	273	173	151	93	92	71	71	152	128	40	37	57	60	110	145	162	142	156	140	163	158	162	115	145	94
Percentage of Deaths in each period of life on total mortality of quarter	14.97	11.62	5.12	4.61	2.92	2.55	1.57	1.55	1.20	1.20	2.57	2.16	.68	.62	.96	1.01	1.86	2.45	2.74	2.40	2.63	2.37	2.75	2.50	2.74	1.94	2.45	1.59
Total of both Sexes	1,574		575		324		185		142		280		77		117		255		304		296		321		277		239	
Percentage of both Sexes on total mortality of quarter	26.59		9.73		5.47		3.12		2.40		4.73		1.30		1.97		4.31		5.14		5.00		5.25		4.68		4.04	

MONTHS.	50-55.		55-60.		60-65.		65-70.		70-75.		75-80.		80-85.		85-90.		90-95.		95-100.		100 and upward.		Total by Sexes.		TOTAL.
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	
January	36	33	27	16	28	20	20	24	11	21	10	19	7	10	9	3	..	1	1	3	..	..	925	809	1,734
February	29	14	25	16	28	18	24	20	14	24	10	11	4	5	3	3	..	1	..	1	..	..	961	840	1,801
March	60	33	32	19	41	30	34	29	18	26	17	20	10	14	4	8	4	2	1	1	..	1	1,293	1,091	2,384
Total	125	80	84	51	97	68	78	73	43	71	37	50	21	29	16	14	4	4	2	5	..	1	3,179	2,740	5,919
Percentage of Deaths in each period of life on total mortality of quarter	2.11	1.35	1.42	.86	1.64	1.15	1.32	1.23	.73	1.20	.62	.84	.35	.49	.27	.24	.07	.07	.03	.08	..	.02	53.71	46.29	.....
Total of both Sexes	205		135		165		151		114		87		50		30		8		7		1		5,919		.....
Percentage of both Sexes on total mortality of quarter	3.46		2.28		2.79		2.55		1.93		1.46		.84		.51		.14		.11		.02		.....		.....

STATE OF THE PUBLIC HEALTH DURING THE QUARTER ENDING APRIL 1ST.

There were 5,919 deaths in New York, and 1,997 in Brooklyn during the winter quarter. The mean temperature was not as low as in the preceding winter; but the range of temperature was excessive in brief periods, fluctuating through forty and even fifty degrees of the thermometric scale in the course of a week. The mortality by acute diseases of the respiratory organs was excessive, amounting to no less than 1,209 deaths, or 20.42 per centum of the total mortality in the thirteen weeks. There were 892 deaths by tubercular phthisis in the same period; and these, with the acute kinds of disease of the respiratory organs, gave 35.49 per centum of the total list of deaths. Scarlatina became unusually fatal before the end of the quarter. It destroyed 299 children in New York, and 153 in Brooklyn. Measles killed 83 in New York, and 15 in Brooklyn. The zymotic diseases altogether destroyed 1,346 lives in New York, or 22.74 per centum of the total that died; and 454, or 22.73 per centum of the total, in Brooklyn.

The typhoid or enteric fever gained foothold in the city at various points. Forty persons died of this fever in the emigrant population of the 12th Ward, on Ward's Island, and nine died in a foul quarter of the 17th Ward. An account of the outbreak in the latter will be found in a report by Sanitary Inspector Dr. Post, in a preceding section of this volume.

There were 17 deaths by small-pox in New York, and none in Brooklyn, during the quarter; and there were 80 cases of this disease discovered in various parts of the city of New York, 8 of which died in the tenements in which they were found.

The death-rates in different districts of the city differed enormously, being from 70 to 90 per centum greater in the 1st, 4th, and 8th Wards than in the 15th Ward. The death-rate steadily, yet slightly, increased week by week, until the end of the quarter. But the causes here mentioned seemed adequately to account for this unsatisfactory state of health. The annexed abstracts present the statistics for these thirteen weeks, or the winter quarter.

THE SPRING QUARTER ENDING JULY 1ST.

A great increase of fatality by measles, which destroyed 298 children, gave to these thirteen weeks 146 more deaths than the total of the winter quarter in New York. There were 1,985 deaths in Brooklyn.

It was ascertained that the increasing fatality of measles and scarlatina was not confined to tenant-house inhabitants. For the first time the general death-rate increased more rapidly than the separate rate in the tenement-houses as a class; and, whatever it may ultimately be found to signify, the circumstance seems to be important. It should here be mentioned that, of the 5,919 deaths in the city and public institutions of New York during the winter quarter, 3,213 occurred in tenement-houses as defined in the law; while, of the 6,065 deaths in the quarter ending July 1st, only 2,891 occurred in tenement-houses.

Two causes undoubtedly coöperated to produce the favorable improvement which now began to be so noticeable in tenement-houses: First, their occupants seek the open air when the cold and storms of winter cease. Secondly, that class of dwellings has been undergoing a great amount of sanitary improvement, especially in regard to the ventilation of halls and apartments. The analysis of this class of facts will require great carefulness and discrimination, and must be based upon much longer experience. Whatever the records of two successive years can now show, will be found in a subsequent section of this report.

The only circumstance that seriously imperilled the public health during this quarter has been fully mentioned in the account of small-pox, given elsewhere. That disease caused forty-five deaths in this quarter. There were upward of one hundred cases in the 16th, 17th, and 20th Wards, between the first of May and the last of June. The rapidity of its diffusion and the means by which it was arrested are among the most useful sanitary experiences of the year.

The temperature of the spring was unusually cold, and it was not until the second week in May that the warmth began to force the vegetation in the gardens and parks. The mean temperature of the first week in May was below 50° Fahrenheit, and no excessive heat was experienced in June; this circumstance was favorable to the success of the great work of vaccination which the Board of Health had undertaken in every street of the city.

Cholera infantum and other diarrhœal diseases began to be numerously reported as causing death soon after the weekly mean temperature reached 70° Fahrenheit; but, in the entire quarter, there were only 103 deaths by cholera infantum, and 338 by all other diarrhœal disorders. The summer opened with a good state of the public health in both cities and throughout all the towns of the Metropolitan District, except in the localities in which scarlatina and measles continued to prevail fatally. In some of the villages these foes of child-life were far more malignant and destructive than in the cities; and, when we consider that no less than 583 children perished in New York by these two maladies during these thirteen weeks, it will readily be seen that the question of limiting or greatly mitigating the ravages of these destroyers is too important to be set aside by the popular empirical conclusion that, against these contagions, the resources of hygiene are unavailing. Medical experience is proving that sanitary science offers available resources in domestic hygiene and in the sick-room, by which these contagions are mitigated, and by which their fatal progress in families and neighborhoods may be in some measure restrained. But, as the application of such special knowledge and uses of hygiene in the domicile and the family is more a matter of personal and domestic concern than of interference and public administration, we must, for the present, regard these outbreaks and the epidemic phenomena of scarlatina and measles as practically inevitable. They greatly increase the death-rate and bring sudden mourning to more families than any other two contagious diseases. The fact, that, as morbid poisons, they operate and destroy, is the first truth which hygiene recognizes in its suggestions for the sanitary measures regarding them.

It was remarked in the past three years that scarlatina reached its maximum and its minimum of fatality in different months in New York and Brooklyn, respectively, and that temperature has seemed to have but slight influence upon the prevalence of this malady, though steady warmth lessens its fatality. Its maximum of deaths was reached in New York, last spring, in the third week of

DEATHS FROM ZYMOTIC DISEASES.

NEW YORK.—DEATHS FROM SMALL-POX, MEASLES, SCARLATINA, DIPHTHERIA, WHOOPING-COUGH, TYPHOID FEVER, TYPHUS FEVER, CHOLERA, CHOLERA INFANTUM, DIARRHŒAL MALADIES, AND OTHER ZYMOTIC DISEASES.

Registered during the Spring Quarter (13 weeks) ending Saturday, July 3, 1869.

WARDS.	Small-pox.	Measles.	Scarlatina.	Diphtheria.	Croup.	Whooping-Cough.	Typhus Fever.	Typhoid Fever.	Cholera.	Cholera Infantum.	Cholera Morbus; other Diarrhœal Diseases.	Other Zymotic Diseases.	Total Deaths from Zymotic Diseases.	Deaths by Accident or Negligence. (*Coroners' Inquests.*)	Total Deaths from all Causes.	Total Population (in Wards), Census of 1865.	Percentage of Zymotic Deaths on Total Mortality.	Deaths per 1,000 annually of the Population from Zymotic Causes.	Deaths per 1,000 annually of the Population from all Causes.	REMARKS.
First	1	10	9	1	2	6	....	1	....	6	11	8	55	16	146	9.852	37.67	22.33	59.28 *a*	(*a*) Castle Garden and Emigrant Depot, 20.
Second..........	....	....	2	....	....	....	....	....	....	....	......	....	2	4	12	1,194	16.67	6.70	40.20	
Third..........	....	2	....	....	1	....	....	....	....	....	1	....	4	5	16	3,367	25.00	4.75	19.00	
Fourth..........	....	19	6	2	5	7	1	2	....	1	1	10	54	13	179	17,352	30.16	12.45	41.26	
Fifth	....	7	3	1	1	6	....	3	....	5	2	4	32	23	144	18,205	22.22	7.03	31.64 *b*	(*b*) New York Hospital, 33.
Sixth	4	18	17	7	6	3	....	2	....	1	4	11	73	3	206	19,754	35.43	14.78	41.71 *c*	(*c*) City Prison, 4.
Seventh..........	....	15	16	4	1	6	3	....	....	7	8	12	72	11	263	36,962	27.38	7.79	28.46	
Eighth..........	....	16	27	8	7	5	....	1	....	3	6	13	86	10	253	30,098	34.00	11.09	33.62	
Ninth..........	....	15	13	1	11	4	1	4	....	3	3	6	61	8	261	38,504	23.33	6.34	27.11 *d*	(*d*) St. Vincent's Hospital, 23.
Tenth	....	1	12	2	6	....	1	1	....	4	14	10	51	8	244	31,537	20.90	6.47	30.95 *e*	(*e*) Essex Prison, 1.
Eleventh..........	2	18	22	7	13	8	2	1	....	11	12	16	112	15	407	58,953	27.52	7.59	27.62 *f*	(*f*) St. Francis's Hospital, 21.
Twelfth........	2	42	8	9	8	7	9	14	....	5	155	60	319	12	528	28,259	60.42	45.15	74.70 *g*	(*g*) House of Refuge, Randall's Island, 1; Inebriate Asylum, 2; Idiot Asylum, Randall's Island, 1; Infants' Hosp., 228; Ward's Island, 126; Randall's Island, 8; Bloomingdale Lunatic Asylum, 6; Colored Orphan Asylum, 2.
Thirteenth	....	2	5	4	6	1	....	1	....	3	5	9	36	2	167	26,388	21.55	5.46	25.31	
Fourteenth.....	1	4	19	3	7	2	....	1	....	4	5	6	52	2	187	23,382	27.81	8.89	31.99	
Fifteenth	....	3	2	1	2	3	1	....	....	1	2	5	20	4	110	25,572	18.18	3.13	17.21	
Sixteenth......	9	4	11	2	3	4	....	....	....	3	5	6	47	5	215	41,972	21.86	4.48	20.49	
Seventeenth ...	6	13	29	11	17	14	3	4	....	12	19	15	143	15	424	79,563	33.73	7.19	21.33	
Eighteenth.....	2	16	16	7	13	9	2	1	....	9	10	7	92	9	413	47,613	22.28	7.73	34.69 *h*	(*h*) Home for Aged and Indigent Females, 3.
Nineteenth.....	14	27	11	4	7	1	5	2	....	7	41	36	155	24	624	39,945	24.84	15.52	62.48 *i*	(*i*) City Lunatic Asylum, 32; Almshouse, 18; Penitentiary, 2; Small-pox, 15; Charity Hospital, 132; Workhouse, 8; Epileptic and Paralytic Hospital, 4; Fever Hospital, 6; R. C. Orphan Asylum, 5; Colored Home Hospital, 25; Nursery and Child's Hospital, 35; St. Luke's Hospital, 33; Woman's Hospital, 4.
Twentieth	2	32	24	6	7	9	....	5	....	7	14	15	121	13	416	61,884	29.10	7.82	26.89 *j*	(*j*) Mount Sinai Hospital, 10.
Twenty-first....	2	6	15	5	4	2	1	2	....	....	10	37	84	56	498	38,669	16.87	8.69	51.51 *k*	(*k*) Bellevue Hospital, 254; Home of the Friendless, 1; Morgue, 2.
Twenty-second.	....	28	18	4	5	9	4	5	....	11	10	13	107	14	352	47,361	30.40	9.02	29.73 *l*	(*l*) House of Mercy, 2.
Totals........	45	298	285	89	132	106	33	50	....	103	338	299	1,778	272	6,065	726,386	29.31	9.79	33.40	Total in Public Institutions, 1,067.

ABSTRACT OF DEATHS REGISTERED IN THE SECOND QUARTER OF THE YEAR 1869.

Sexes, Nativities, Ages, and Percentages, at each Period.

MONTHS.	MALES.	FEMALES.	TOTAL.	UNITED STATES.	FOREIGN.
April	982	825	1,807	1,179	628
May	1,012	904	1,916	1,233	683
June	1,248	1,094	2,342	1,558	784
Total	3,242	2,823	6,065	3,970	2,095

MONTHS.	Under 1 year of age.		1-2.		2-3.		3-4.		4-5.		5-10.		10-15.		15-20.		20-25.		25-30.		30-35.		35-40.		40-45.		45-50.	
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
April	218	219	98	88	62	53	35	24	21	23	54	35	14	6	29	19	35	40	44	34	63	33	56	39	39	26	56	35
May	248	248	109	116	75	48	36	37	23	26	43	36	21	6	18	17	31	43	52	46	50	29	56	35	59	38	46	31
June	347	325	153	156	87	66	48	34	26	24	48	38	23	15	19	19	37	48	46	44	66	41	59	48	59	47	56	27
Total	813	792	360	360	224	167	119	95	70	73	145	109	58	27	66	55	103	131	142	124	179	103	171	122	157	111	158	93
Percentage of Deaths in each period of life on total mortality of quarter	13.40	13.06	5.94	5.93	3.69	2.75	1.96	1.57	1.15	1.20	2.39	1.80	.96	.44	1.09	.91	1.70	2.16	2.34	2.04	2.95	1.70	2.82	2.01	2.59	1.83	2.61	1.53
Total of both Sexes	1,605		720		391		214		143		254		85		121		234		266		282		293		268		251	
Percentage of both Sexes on total mortality of quarter	26.46		11.87		6.44		3.53		2.35		4.19		1.40		2.00		3.86		4.38		4.65		4.83		4.42		4.14	

MONTHS.	50-55.		55-60.		60-65.		65-70.		70-75.		75-80.		80-85.		85-90.		90-95.		95-100.		100 and upward.		Total by Sexes.		TOTAL.
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	
April	43	21	29	12	27	24	24	34	17	18	7	23	7	9	1	7	1	3	2	..	..	..	982	825	1,807
May	32	27	20	14	29	24	21	20	19	19	8	15	11	15	3	8	2	2	..	2	..	2	1,012	904	1,916
June	51	32	33	28	30	19	25	26	19	20	6	17	6	9	2	5	..	5	1	1	1	..	1,248	1,094	2,342
Total	126	80	82	54	86	67	70	80	55	57	21	55	24	33	6	20	3	10	3	3	1	2	3,242	2,823	6,065
Percentage of Deaths in each period of life on total mortality of quarter	2.08	1.32	1.35	.89	1.42	1.10	1.15	1.32	.91	.94	.35	.91	.40	.54	.10	.33	.05	.16	.05	.05	.02	.03	....	....	.....
Total of both Sexes	206		136		153		150		112		76		57		26		13		6		3		6,065		.....
Percentage of both Sexes on total mortality of quarter	3.40		2.24		2.52		2.47		1.85		1.26		.94		.43		.21		.10		.05		.....		.....

April, yet, in the last week of February that number (30) was exceeded by four (34 by scarlatina), while the deaths by measles did not reach the highest number until the third week of June (the mildest and most healthful week in the year), when no less than 36 children died from this cause.

These facts are mentioned to show what causes were most concerned in keeping up a high death-rate last spring, and also to urge attention to the only resources that are available against the fatal sweep of the subtle contagions here mentioned. Nearly one-tenth of the total mortality in the Metropolitan District, during the three months ending July 1st, was caused by these two diseases; and their fatality alone was equal to a yearly death-rate of 2.33 in every 1,000, or 2,332 in 1,000,000 of inhabitants. Very different from the course of these maladies was the course of small-pox, the most dreaded yet most preventable of contagions; for, in a single ward in which it was spreading at the rate of five new cases or fresh outbreaks in a day, the disease was completely suppressed and the people protected by vaccination at an expenditure of about $600 in house-to-house visitation in a population of 70,000 inhabitants.

Notwithstanding the diseases here mentioned, the summer opened favorably to the public health, for there was not the usual intemperature of heated periods at the end of June and the beginning of July. The mean temperature of the last two weeks in this quarter was 72.97° Fahrenheit.

THIRD QUARTER—ENDING OCTOBER 1st.

The midsummer period in New York and all the cities of our Atlantic coast, from Boston to Savannah, is marked by the highest mortality of the year. With excesses of temperature almost tropical, not only do disorders of the bowels do fatal mischief, but the nervous system, in multitudes of persons, feels the effects of the sudden transitions of temperature very unfavorably. It cannot be doubted that the uniformity and moderation of heat in the month of July was favorable to the public health; but, that this aspect of our summer experience need not be overestimated, we here give a comparative view of the death-rates and weather-tables in three consecutive summers:

WEEKS.	1867.				1868.				1869.			
	Mean Temperature.	Deaths by Zymotic Diseases.	Deaths by Diarrhœal Diseases.	Total Mortality.	Mean Temperature.	Deaths by Zymotic Diseases.	Deaths by Diarrhœal Diseases.	Total Mortality.	Mean Temperature.	Deaths by Zymotic Diseases.	Deaths by Diarrhœal Diseases.	Total Mortality.
July, 1st week....	77	145	67	472	80	131	51	413	74.42	296	212	642
" 2d "	72	208	149	525	80	259	176	614	70.53	373	284	726
" 3d "	68	263	196	582	88	489	416	1,142	76.27	368	283	692
" 4th "	75	350	267	677	78	428	368	781	72.45	306	234	631
August, 1st "	73	329	250	647	80	396	348	730	75.15	269	200	591
" 2d "	75	327	254	708	78	396	326	751	71.14	276	204	587
" 3d "	76	312	229	640	74	318	255	643	73.59	283	185	592
" 4th "	75	264	213	608	76	368	291	732	76.81	264	199	606
Total...............	73.87	2,198	1,625	4,859	79.25	2,785	2,231	5,806	73.79	2,435	1,801	5,067
Succeeding five weeks, ending Oct. 3............	64.60	883	594	2,547	66.20	937	657	2,609	67.40	723	414	2,323
Total 13 weeks....	69.83	3,081	2,219	7,406	72.72	3,722	2,888	8,415	70.59	3,158	2,215	7,390

In the above abstract the fact is seen that the mean temperature of the midsummer period of two months in the last summer was essentially the same as that in 1867, so that, comparing this average of temperature with that in the corresponding period in 1868, it was 5.46° lower. But, upon comparing the average temperature of the quarter (thirteen weeks) in the last season with that in 1868, it was found to have been only 2.13° warmer in the latter; and, comparing the summer quarter of 1867 and 1869, the mean temperature was 1.30° higher than in the former remarkably healthful summer.

The second fact to be noticed is that which relates to the total mortality, or the death-rates in the successive years. It is shown in the foregoing abstract that the total deaths in the thirteen weeks ending October 1, 1869, was less than the total in the corresponding weeks in 1868 by no less than 1,125, and also less than in the same weeks in 1867.

The next fact which we notice is, that all except a small fraction of the gain to life last summer was found in the diminished mortality from diarrhœal disorders; and lastly, that this gain occurred in the last five weeks of the quarter. There were 214 more deaths in the last five weeks of the summer quarter of 1867, and 286 more in the same weeks of 1868, than in the corresponding period in 1869. This special gain occurred chiefly in the group of diseases which affect the bowels, yet there were several other sources of gain. We may here mention one grand cause and class in which the whole gain was found, and this may best be stated as follows:

IN THE WEEK ENDING	1868.				1869.			
	DEATHS IN				DEATHS IN			
	Public Institutions.	Private Dwellings, Hotels, and Boarding-houses.	Tenement-houses.	Total Mortality.	Public Institutions.	Private Dwellings, Hotels, and Boarding-houses.	Tenement-houses.	Total Mortality.
September 5.........	96	139	364	599	75	128	301	504
" 12.........	83	117	369	569	74	161	245	480
" 19.........	86	134	295	515	64	151	236	451
" 26.........	79	109	266	454	76	121	254	451
October 3.........	112	100	260	472	54	184	199	437

Here we discover the instructive fact that the gain to life occurred, as a whole, in the tenement-houses, and that the total gain in this class of dwellings, and in the tenant-house districts of the city, exceeded the aggregate difference in the mortality-tables for the period in the two years.

The mean temperature in these last five weeks of the quarter was 67.40° Fahr., or 1.20° warmer than in 1868, and 2.80° warmer than in 1867. Whatever may have been the atmospheric and other external conditions that served to promote the chances of life, we need not stop to inquire; but the fact is worthy of a statement here that the cleansing of streets and gutters, and the thorough treatment of all foul places and privies throughout the tenement-house regions with disinfectants (a cheap and effective mixture of sesquichloride

DEATHS FROM ZYMOTIC DISEASES.

NEW YORK.—DEATHS FROM SMALL-POX, MEASLES, SCARLATINA, DIPHTHERIA, WHOOPING-COUGH, TYPHOID FEVER, TYPHUS FEVER, CHOLERA, CHOLERA INFANTUM, DIARRHŒAL MALADIES, AND OTHER ZYMOTIC DISEASES.

Registered during the 13 weeks ending Saturday, October 3, 1869.

WARDS.	Small-pox.	Measles.	Scarlatina.	Diphtheria.	Croup.	Whooping-Cough.	Typhus Fever.	Typhoid Fever.	Cholera.	Cholera Infantum.	Cholera Morbus; other Diarrhœal Diseases.	Other Zymotic Diseases.	Total Deaths from Zymotic Diseases.	Deaths by Accident or Negligence. (*Coroners' Inquests.*)	Total Deaths from all Causes.	Total Population (in Wards), Census of 1865.	Percentage of Zymotic Deaths on Total Mortality.	Deaths per 1,000 annually of the Population from Zymotic Causes.	Deaths per 1,000 annually of the Population from all Causes.	REMARKS.
First	....	3	....	....	4	2	....	1	....	19	11	2	42	8	122	9.852	34.43	17.05	49.53 *a*	(*a*) Castle Garden and Emigrant Depot, 9.
Second	....	....	1	....	....	2	....	....	....	4	2	....	9	1	23	1,194	39.13	30.15	77.50	
Third	....	....	....	1	....	....	....	....	....	2	3	2	8	2	19	3,367	42.10	9.50	22.57	
Fourth	....	1	2	....	2	2	....	3	....	26	25	6	67	6	174	17,352	38.50	15.44	40.11	
Fifth	....	3	8	....	....	4	1	4	1	21	16	8	66	20	165	18,205	40.00	14.50	36.25 *b*	(*b*) New York Hospital, 20.
Sixth	1	10	4	3	2	2	2	1	1	49	27	14	116	6	257	19,754	45.14	23.49	52.04 *c*	(*c*) City Prison, 4.
Seventh	....	4	14	2	....	5	....	4	....	73	31	11	144	11	339	36,962	42.48	15.58	36.69	
Eighth	1	1	7	3	2	4	2	....	....	51	37	7	115	12	293	30,098	39.25	15.28	38.94	
Ninth	....	3	5	3	4	8	1	5	....	43	40	8	120	10	282	38,504	42.55	12.47	29.30 *d*	(*d*) St. Vincent's Hospital, 27.
Tenth	....	3	13	5	2	4	1	3	....	40	52	10	133	6	305	31,537	43.61	16.87	38.68 *e*	(*e*) Essex Market Prison, 1.
Eleventh	5	12	9	5	5	10	1	9	....	75	88	4	223	13	520	58,953	42.88	15.13	35.29 *f*	(*f*) St. Francis's Hospital, 27.
Twelfth	....	23	5	5	3	2	8	23	....	89	160	62	380	17	641	28,259	59.28	53.78	90.73 *g*	(*g*) Ward's Island, 174; Randall's Island, 0; Bloomingdale Lunatic Asylum, 7; House of Good Shepherd, 1; House of Refuge, 1; N. Y. Juvenile Asylum, 1; Nursery Hospital, 15; Infants' Hospital, 178; Colored Orphan Asylum, 3; Deaf and Dumb Asylum, 1.
Thirteenth	2	7	7	4	2	3	....	1	1	32	35	8	102	5	235	26,388	48.40	15.46	35.62	
Fourteenth	....	8	3	2	....	1	1	3	....	35	27	5	85	1	220	23,382	38.64	14.54	37.64	
Fifteenth	....	....	2	....	1	....	....	1	....	13	14	4	35	3	100	25,572	35.00	5.47	15.64	
Sixteenth	1	3	14	3	1	6	....	3	....	44	42	13	130	10	313	41,972	41.53	12.39	29.83	
Seventeenth	1	6	15	5	9	16	3	1	1	93	134	18	302	6	688	79,563	43.89	15.18	34.59	
Eighteenth	4	2	8	2	4	8	1	6	....	55	52	9	151	7	343	47,613	44.02	12.69	28.82	
Nineteenth	12	29	8	7	2	16	2	13	....	83	119	20	311	23	802	39,945	38.78	31.14	80.31 *h*	(*h*) City Lunatic Asylum, 22; Almshouse, 15; Penitentiary, 1; Small-pox, 18; Charity Hospital, 138; Epileptic and Paralytic Hosp., 11; Fever Hospital, 1; Workhouse, 5; Colored Home Hospital, 27; Nursery and Child's Hospital, 47; St. Luke's Hospital, 38; R. C. Orphan Asylum, 2.
Twentieth	....	3	12	5	4	5	2	3	2	79	86	17	218	5	491	61,884	44.40	14.09	31.74 *i*	(*i*) Mount Sinai Hospital, 7.
Twenty-first	2	1	8	4	2	3	2	1	....	37	59	42	161	64	517	38,669	31.14	16.65	53.48 *j*	(*j*) Bellevue Hospital, 225; Home of the Friendless, 7; Morgue (unknown), 7.
Twenty-second	3	6	14	7	4	16	....	2	....	81	95	12	240	16	541	47,361	44.36	20.27	45.69 *k*	(*k*) N. Y. Orphan Asylum, 1.
Totals	32	128	159	66	53	119	27	87	6	1,044	1,155	282	3,158	252	7,390	726,386	42.73	17.39	40.69	Total in Public Institutions, 1,041.

ABSTRACT OF DEATHS REGISTERED IN THE THIRD QUARTER OF THE YEAR 1869.

Sexes, Nativities, Ages, and Percentages, at each Period.

MONTHS.	MALES.	FEMALES.	TOTAL.	UNITED STATES.	FOREIGN.
July	1,387	1,304	2,691	2,043	648
August	1,283	1,093	2,376	1,681	695
September	1,239	1,084	2,323	1,555	768
Total	3,909	3,481	7,390	5,279	2,111

MONTHS.	Under 1 year of age.		1-2.		2-3.		3-4.		4-5.		5-10.		10-15.		15-20.		20-25.		25-30.		30-35.		35-40.		40-45.		45-50.	
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
July	655	575	180	182	72	62	30	34	21	25	41	30	19	12	17	23	33	43	36	46	52	36	27	31	36	34	29	42
August	497	376	202	180	50	51	20	26	18	19	43	31	25	12	24	15	40	37	56	43	47	45	52	38	34	37	42	26
September	395	347	179	167	50	33	30	23	21	13	35	34	19	14	19	29	48	45	51	52	56	44	47	48	64	40	49	38
Total	1,547	1,298	561	529	172	146	80	83	60	57	119	95	63	38	60	67	121	125	143	141	155	125	126	117	134	111	120	106
Percentage of Deaths in each period of life on total mortality of quarter	20.93	17.56	7.59	7.16	2.33	1.97	1.08	1.12	.81	.77	1.61	1.29	.85	.51	.81	.91	1.64	1.69	1.94	1.91	2.10	1.69	1.71	1.58	1.81	1.50	1.62	1.43
Total of both Sexes	2,845		1,090		318		163		117		214		101		127		246		284		280		243		245		226	
Percentage of both Sexes on total mortality of quarter	38.49		14.75		4.30		2.20		1.58		2.90		1.36		1.72		3.33		3.85		3.79		3.29		3.31		3.05	

MONTHS.	50-55.		55-60.		60-65.		65-70.		70-75.		75-80.		80-85.		85-90.		90-95.		95-100.		100 and upward.		Total by Sexes.		TOTAL.
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	
July	43	26	26	17	24	16	19	21	9	18	9	12	3	9	6	6	..	2	..	1	..	1	1,387	1,304	2,691
August	31	32	22	29	31	28	16	27	14	13	7	11	8	11	4	3	..	3	..	..	..	..	1,283	1,093	2,376
September	43	27	38	19	30	27	23	22	10	25	13	13	12	14	4	8	2	..	..	1	1	1	1,239	1,084	2,323
Total	117	85	86	65	85	71	58	70	33	56	29	36	23	34	14	17	2	5	..	2	1	2	3,909	3,481	7,390
Percentage of Deaths in each period of life on total mortality of quarter	1.58	1.15	1.16	.88	1.15	.96	.78	.95	.45	.76	.39	.47	.31	.46	.19	.23	.03	.07	..	.03	.01	.03	52.90	47.10	.....
Total of both Sexes	202		151		156		128		89		65		57		31		7		2		3		7,390		.....
Percentage of both Sexes on total mortality of quarter	2.73		2.04		2.11		1.73		1.21		.86		.77		.42		.10		.03		.04		.....		.....

of iron, and carbolic acid), during ten weeks of this summer period (from July 14th to October 1st), almost entirely held in abeyance the putrescence and atmospheric offensiveness throughout the crowded districts of the city. Enough was ascertained, concerning the results to health that ensued upon this kind of sanitary cleansing, to prove the economy and the necessity of such measures.

The diminished force of the causes, singly or combined, which produce fatal fluxes of the bowels, was the leading peculiarity in the medical history of the three months ending October 1st; and, while this circumstance undoubtedly saved many lives that may long remain vigorous and useful, this saving nevertheless has resulted in temporarily continuing a considerable number of enfeebled and puny lives which inevitably must succumb to physical adversities in the first trying season. This gain was mainly in lives of children under five years of age, and, in the overcrowded tenements, when the pinching cold comes on, some of them will be found added to the mortality-lists. But there is a useful lesson in this record of decrease of causes of fatality of bowel-disorders, which will encourage future endeavors to maintain a cleanly condition of the city, and a more general application of disinfectants to prevent those fermentations which in past years have defiled the atmosphere with the offensive effluvia that produce incurable disorders of the bowels. Cleanliness must be enforced, by arbitrary authority if need be, in such a city as New York, and disinfection must not be presumed to be a substitute for cleansing, for it is only an aid to purity.

In order to give a correct idea of the distribution and variableness of this gain, the following comparisons of the mortality in the summer quarter in each ward in 1868 and 1869 are presented. (See p. 257.)

In the present state of medical knowledge it would seem to be needless to urge the importance of civic and domestic cleanliness to prevent the prevalence of diarrhœal diseases, for the fact is abundantly demonstrated that, whatever be the mode in which putrefying elements may reach the circulating blood, the products of such filth and rottenness are sure to seek an outflow from the bowels, and to irritate and disorder them; or, in the forcible language of one of the most practical writers and learned hygienists of our times, "In the districts that suffer the high diarrhœal death-rates, the population breathes (or drinks) a large amount of putrefying refuse; .... and as wine gets into the head, so these putrescent agents get into the bowels, and, as their universal result, produce diarrhœa — simple diarrhœas, in the absence of specific infections, specific diarrhœa, when the ferments of cholera or typhoid fever are in operation."

Simple and direct as some of the causes of disease are, as in the case of bowel-fluxes and fatal disorder ensuing upon the breathing of putrescent exhalations, like gases and vapors from foul privies, sewers, and putrid garbage, or from unwholesome and decaying foods, we find, in these overcrowded cities, that even such very obvious and abounding sources of summer diseases rarely act simply and alone; for in the localities where filth abounds are found all the accumulated evils of overcrowded tenements, impure and decaying foods, unhealthful habits, destructive vices, forlorn and despairing social conditions, and the whole category of sanitary and domestic wants that war against health and healthy life. We repeat in this, as in former reports, this most important of

WARDS.	*First.*	*Second.*	*Third.*	*Fourth.*	*Fifth.*	*Sixth.*	*Seventh.*	*Eighth.*	*Ninth.*	*Tenth.*	*Eleventh.*	*Twelfth.*	*Thirteenth.*	*Fourteenth.*	*Fifteenth.*	*Sixteenth.*	*Seventeenth.*	*Eighteenth.*	*Nineteenth.*	*Twentieth.*	*Twenty-first.*	*Twenty-second.*	TOTAL.
DEATHS IN SUMMER QUARTER OF 1868	182	12	29	225	232	241	412	309	334	334	624	868	305	257	121	350	857	393	722	635	550	666	8,658
" " 1869	122	23	19	174	165	257	339	293	282	305	520	641	235	220	100	313	688	343	802	491	517	541	7,390
Difference.... 1868 over 1869	60	....	10	51	67	....	73	16	52	29	104	227	70	37	21	37	169	50	....	144	33	125	1,268
Difference.... 1869 " 1868	....	11	....	....	....	16	....	....	....	....	....	....	....	....	....	....	....	....	80	....	....	....	......
DEATHS BY DIARRHŒAL DISEASES IN SUMMER QUARTER OF 1868	74	....	9	73	54	85	156	88	104	117	260	407	111	71	30	105	348	133	234	214	149	254	3,076
" " " " " 1869	30	6	5	51	38	77	104	88	83	92	163	249	68	62	27	86	228	107	202	167	96	176	2,205
Difference.... 1868 over 1869	44	....	4	22	16	8	52	....	21	25	97	158	43	9	3	19	120	26	32	47	53	78	871
Difference.... 1869 " 1868	....	6	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	......
DEATHS BY ZYMOTIC CAUSES IN SUMMER QUARTER OF 1868	79	2	12	86	73	103	181	110	125	145	311	590	139	94	44	126	410	157	306	271	194	312	3,870
" " " " " 1869	42	9	8	67	66	116	144	115	120	133	223	380	102	85	35	130	302	151	311	218	161	240	3,158
Difference.... 1868 over 1869	37	....	4	19	7	....	37	....	5	12	88	210	37	9	9	....	108	6	....	53	33	72	712
Difference.... 1869 " 1868	....	7	....	....	....	13	....	5	....	....	....	....	....	....	....	4	....	....	5	....	....	....	......

all truths concerning the sanitary improvement of the laboring-classes, namely, that the efforts of sanitary officers to promote the physical improvement of the homes of these classes must, to be fully triumphant in reducing the death-rates, be accompanied by popular instruction in the kinds of knowledge and duties that constitute the science and art of healthy living. Boards of Health may prevent great excesses of mortality at particular periods, but the efforts of health-officers must be so directed as to instruct the masses of the people, if permanent and very great reforms are to be brought about. We cannot, therefore, speak of the temporary gains that have saved the city from its usual losses at a particular period, as being evidence of truly permanent gains. The temporary gains, which, of course, appear where the preventable invasions of disease are turned back, save many useful lives, but the great mass of human life escapes the one short period of peril only to continue on in a warfare against constant evils that are not completely within the control of sanitary officers.

The annual chart of mortality, as we have already seen, exhibits only a slight fluctuation in the upward curves for that month. Possibly this uniformity of a low rate of mortality in our summer months can be secured in all subsequent summers. During the past five years such a uniformity of low mortality has been experienced in the city of Paris, the mean there, in the hot months, being only a fraction above a yearly death-rate of 22 in 1,000 inhabitants: Such a low death-rate was impossible in that city previous to the great reforms in its streets, sewerage and sanitary administration. Berlin had a death-rate equal to 35 or more per 1,000, the past summer, and the causes of its great mortality, like the causes in New York, are of local origin. Like the health of vast military encampments and barracks, the health of a great city depends mainly upon vigilant measures of sanitary police, and the drainage and healthfulness of location; and both in camp and city the most fatal summer diseases owe their origin and malignancy to self-produced causes.

FOURTH QUARTER—ENDING DECEMBER 31, 1869.

The autumnal quarter in the cities of New York and Brooklyn was more favorable to human life than the previous quarters; and this special healthfulness of the last three months of the twelve would appear, from evidence that we find in the mortality-records, to have been growing more and more obvious since the sewerage of these cities was commenced. But the balances in favor of life during the autumnal quarter the past year are greater within the metropolis than in the suburban villages. In the city the fatal disorders of the bowels rapidly decrease, while in the rural districts they increase in consequence of local causes resulting from defects of drainage, sewerage, and water supply. These local sanitary conditions, more than any others, act in determining these results in city and country.

DEATHS FROM ZYMOTIC DISEASES.

NEW YORK.—DEATHS FROM SMALL-POX, MEASLES, SCARLATINA, DIPHTHERIA, WHOOPING-COUGH, TYPHOID FEVER, TYPHUS FEVER, CHOLERA, CHOLERA INFANTUM, DIARRHŒAL MALADIES, AND OTHER ZYMOTIC DISEASES.

Registered during the 13 weeks ending December 31, 1869.

WARDS.	Small-pox.	Measles.	Scarlatina.	Diphtheria.	Croup.	Whooping-Cough.	Typhus Fever.	Typhoid Fever.	Cholera.	Cholera Infantum.	Cholera Morbus; other Diarrhœal Diseases.	Other Zymotic Diseases.	Total Deaths from Zymotic Diseases.	Deaths by Accident or Negligence. (*Coroners' Inquests.*)	Total Deaths from all Causes.	Total Population (in Wards), Census of 1865.	Percentage of Zymotic Deaths on Total Mortality.	Deaths per 1,000 annually of the Population from Zymotic Causes.	Deaths per 1,000 annually of the Population from all Causes.	REMARKS.
First	....	1	2	1	5	....	1	1	....	....	2	6	19	9	104	9,852	18.27	7.71	42.22 *a*	(*a*) Castle Garden and Emigrant Depot, 4.
Second	....	....	....	....	....	....	....	....	....	....	......	....	......	5	10	1,194	......	......	33.50	
Third	....	....	1	....	....	....	....	....	....	....	1	....	2	2	13	3,367	15.38	23.76	15.44	
Fourth	1	....	8	....	9	3	1	4	....	1	6	15	48	11	184	17,352	26.09	11.05	42.42	
Fifth	....	....	5	1	4	....	1	5	....	1	1	6	24	19	125	18,205	19.20	52.73	27.46 *b*	(*b*) New York Hospital, 19.
Sixth	1	1	10	7	3	....	1	7	....	....	5	17	52	10	229	19,754	22.71	10.53	46.37 *c*	(*c*) City Prison, 6; House of Industry, 1.
Seventh	....	....	12	4	6	2	....	3	....	3	7	14	51	6	250	36,962	20.40	55.18	27.05	
Eighth	....	....	10	4	5	4	....	7	....	....	5	8	43	11	232	30,098	18.53	5.71	30.83	
Ninth	1	1	5	2	6	2	3	10	....	2	6	5	43	6	245	38,504	17.55	44.67	25.45 *d*	(*d*) St. Vincent's Hospital, 20; Jefferson Market Prison, 1.
Tenth	1	1	7	4	4	....	....	6	....	1	7	6	37	11	203	31,537	18.22	4.69	25.75	
Eleventh	40	3	14	6	16	1	4	5	....	3	13	11	116	10	376	58,953	30.85	7.87	25.51 *e*	(*e*) St. Francis's Hospital, 23.
Twelfth	1	5	9	1	5	1	6	17	....	15	60	58	178	7	392	28,259	45.41	25.19	55.49 *f*	(*f*) Ward's Island, 109; Randall's Island, 9; Bloomingdale Lunatic Asylum, 9; Infants' Hospital, 94; Colored Orphan Asylum, 1; House of Good Shepherd, 1; N. Y. Juvenile Asylum, 1; Deaf and Dumb Asylum, 2.
Thirteenth	3	....	7	4	6	2	1	5	....	2	3	6	39	6	187	26,388	20.86	5.91	28.35	
Fourteenth	1	....	9	4	7	2	2	1	....	2	7	8	43	8	193	23,382	22.28	7.35	33.17	
Fifteenth	....	....	6	....	1	1	....	4	....	1	4	5	22	8	130	25,572	16.92	3.44	20.33 *g*	(*g*) Foundling Asylum, 32.
Sixteenth	1	....	4	8	8	1	1	....	....	....	8	10	41	9	208	41,972	19.71	3.91	19.85 *h*	(*h*) St. Joseph's Home, 1.
Seventeenth	30	1	13	6	13	12	4	12	....	5	12	20	128	15	520	79,563	24.62	6.44	26.14	
Eighteenth	16	1	15	4	7	3	....	1	....	3	8	6	64	7	292	47,613	21.92	5.37	24.53	
Nineteenth	8	....	34	8	9	6	1	31	....	4	45	31	177	10	733	39,945	24.13	1.77	73.40 *i*	(*i*) City Lunatic Asylum, 37; Almshouse, 26; Penitentiary, 0; Small-pox, 8; Charity Hospital, 149; Epileptic and Paralytic Hospital, 10; Colored Home Hospital, 32; Nursery and Child's Hospital, 33; St. Luke's Hospital, 35; Fever Hospital, 12; Inebriate Asylum, 1; German Hospital, 13; R. C. Orphan Asylum, 1; Workhouse, 6.
Twentieth	....	1	12	9	7	3	4	10	....	....	14	25	85	6	366	61,884	23.22	5.49	23.66 *j*	(*j*) Mount Sinai Hospital, 13.
Twenty-first	1	....	21	1	7	3	1	5	....	3	17	37	96	63	451	38,669	21.28	9.93	46.65 *k*	(*k*) Bellevue Hospital, 230; Home of the Friendless, 2.
Twenty-second	4	2	19	12	7	2	1	5	....	1	17	17	87	7	350	47,361	24.86	7.34	29.55	
Totals	109	17	223	86	135	48	32	139	....	47	248	311	1,395	246	5,793	726,386	24.08	7.71	31.90	Total in Public Institutions, 941.

ABSTRACT OF DEATHS REGISTERED IN THE FOURTH QUARTER OF THE YEAR 1869.

Sexes, Nativities, Ages, and Percentages, at each Period.

MONTHS.	MALES.	FEMALES.	TOTAL.	UNITED STATES.	FOREIGN.
October	919	865	1,784	1,104	680
November	928	819	1,747	952	795
December	1,192	1,070	2,262	1,407	855
Total	3,039	2,754	5,793	3,463	2,330

MONTHS.	Under 1 year of age.		1-2.		2-3.		3-4.		4-5.		5-10.		10-15.		15-20.		20-25.		25-30.		30-35.		35-40.		40-45.		45-50.	
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
October	263	205	96	104	37	31	27	17	12	25	30	19	10	14	24	20	38	43	50	51	46	40	48	58	46	44	48	38
November	204	164	73	60	35	31	27	21	12	14	38	23	15	12	21	24	32	51	51	54	50	38	56	59	57	43	63	36
December	289	256	112	76	67	61	39	40	27	28	40	43	18	22	21	23	51	54	54	66	70	62	68	53	50	54	61	46
Total	756	625	281	240	139	123	93	78	51	67	108	85	43	48	66	77	121	148	155	171	166	140	172	170	153	141	172	120
Percentage of Deaths in each period of life on total mortality of quarter	13.05	10.79	4.85	4.14	2.40	2.12	1.61	1.35	.88	1.16	1.86	1.47	.74	.83	1.14	1.33	2.09	2.38	2.68	2.95	2.87	2.42	2.97	2.93	2.64	2.43	2.97	2.07
Total of both Sexes	1,381		521		262		171		118		193		91		143		269		326		306		342		294		292	
Percentage of both Sexes on total mortality of quarter	23.84		8.99		4.52		2.96		2.04		3.33		1.57		2.47		4.47		. 5.63		5.29		5.90		5.07		5.04	

MONTHS.	50-55.		55-60.		60-65.		65-70.		70-75.		75-80.		80-85.		85-90.		90-95.		95-100.		100 and upward.		Total by Sexes.		TOTAL.
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	
October	28	37	33	24	29	20	21	23	15	15	11	18	4	11	2	6	..	2	1	..	..	..	919	865	1,784
November	51	30	31	28	30	31	28	31	26	23	12	23	8	9	6	8	2	6	..	..	..	..	928	819	1,747
December	48	29	46	27	43	31	28	34	16	25	29	19	8	12	4	4	3	3	..	1	..	1	1,192	1,070	2,262
Total	127	96	110	79	102	82	77	88	57	63	52	60	20	32	12	18	5	11	1	1	..	1	3,039	2,754	5,793
Percentage of Deaths in each period of life on total mortality of quarter	2.19	1.66	1.90	1.36	1.76	1.42	1.33	1.52	.98	1.09	.89	1.04	.35	.55	.21	.31	.09	.19	.02	.02	..	.02	....	....	.....
Total of both Sexes	223		189		184		165		120		112		52		30		16		2		1		5,793		.....
Percentage of both Sexes on total mortality of quarter	3.85		3.26		3.18		2.85		2.07		1.93		.90		.52		.28		.04		.02		.....		.....

DEATHS FROM ZYMOTIC DISEASES.

NEW YORK.—DEATHS FROM SMALL-POX, MEASLES, SCARLATINA, DIPHTHERIA, WHOOPING-COUGH, TYPHOID FEVER, TYPHUS FEVER, CHOLERA, CHOLERA INFANTUM, DIARRHŒAL MALADIES, AND OTHER ZYMOTIC DISEASES.

Registered during the 12 months ending December 31, 1869.

WARDS.	Small-pox.	Measles.	Scarlatina.	Diphtheria.	Croup.	Whooping-Cough.	Typhus Fever.	Typhoid Fever.	Cholera.	Cholera Infantum.	Cholera Morbus; other Diarrhœal Diseases.	Other Zymotic Diseases.	Total Deaths from Zymotic Diseases.	Deaths by Accident or Negligence. (*Coroners' Inquests.*)	Total Deaths from all Causes.	Total Population (in Wards), Census of 1865.	Rate of Population to square Mile (Census).	Percentage of Zymotic Deaths on Total Mortality.	Death-rate per 1,000 annually of the Population, from Zymotic Causes.	Death-rate per 1,000 annually, exclusive of the mortality in Public Institutions.	Death-rate per 1,000 annually of the Population, from all Causes.
First	1	14	12	3	14	10	2	4	....	25	24	20	129	38	466	9,852	41,050	27.68	13.09	43.75	46.29 *a*
Second..........	...	....	3	....	....	2	1	....	....	4	2	1	13	11	51	1,194	9,950	25.49	10.88	42.71	42.71
Third..........	....	2	1	1	1	....	....	....	....	2	5	3	15	12	66	3,367	22,447	22.73	4.46	19.60	19.60
Fourth	1	20	21	3	20	14	2	14	....	29	34	41	199	33	690	17,352	133,447	28.84	11.46	39.77	39.77
Fifth	....	10	17	3	12	11	3	14	1	27	20	28	146	83	582	18,205	69,904	25.09	8.05	25.31	31.97 *b*
Sixth..........	6	29	36	19	14	8	3	13	1	50	37	48	264	23	854	19,754	151,954	30.91	13.36	42.37	43.19 *c*
Seventh..........	....	25	55	18	12	19	5	10	....	83	50	43	320	37	1,124	36,962	119,232	28.47	8.65	30.41	30.41
Eighth..........	2	18	57	18	21	21	3	11	....	54	53	41	299	38	1,045	30,098	103,786	28.61	9.93	27.43	27.43
Ninth..........	1	19	48	10	25	18	5	19	....	48	52	30	275	34	1,056	38,504	77,204	26.04	7.14	24.69	27.43 *d*
Tenth	2	6	43	16	23	6	3	11	....	45	75	32	262	33	962	31,537	185,512	27.36	8.30	30.44	30.44 *e*
Eleventh..........	49	49	76	25	52	23	9	19	....	89	121	42	554	44	1,704	58,953	196,510	32.51	9.39	27.43	28.90 *f*
Twelfth..........	3	98	27	22	21	14	30	94	....	109	485	248	1,151	42	2,124	28,259	5,195	54.19	40.73	25.66	75.16 *g*
Thirteenth.....	5	14	26	17	21	7	1	7	1	37	46	25	207	16	777	26,388	155,224	26.64	7.84	25.65	25.65
Fourteenth.....	2	12	38	10	22	6	3	6	....	41	42	23	205	15	757	23,382	155,880	27.08	8.77	32.33	32.33 *h*
Fifteenth	....	3	14	3	9	5	1	8	....	15	24	22	104	21	473	25,572	82,490	21.99	4.06	17.25	18.49 *i*
Sixteenth......	11	7	42	16	17	15	1	4	....	48	57	42	260	27	972	41,972	69,953	26.75	6.18	23.06	23.06 *j*
Seventeenth ...	38	32	100	37	63	48	21	26	1	111	175	77	729	45	2,214	79,563	153,206	32.93	9.16	27.81	27.81 *k*
Eighteenth.....	22	23	50	18	43	29	4	14	....	67	72	31	373	28	1,353	47,613	51,197	27.57	7.83	28.35	28.35 *l*
Nineteenth.....	43	62	69	22	24	28	11	51	....	95	219	112	736	71	2,701	39,945	16,713	27.21	18.43	35.25	67.62 *m*
Twentieth	2	38	78	25	24	28	7	24	2	86	118	70	502	35	1,699	61,884	91,206	29.54	8.11	26.74	27.45 *n*
Twenty-first....	7	9	60	14	23	14	5	13	....	40	92	144	421	214	1,934	38,669	52,255	21.25	10.88	26.22	49.24 *o*
Twenty-second.	8	36	93	28	22	32	5	16	....	93	127	52	512	47	1,563	47,361	21,334	32.76	10.81	32.98	32.98 *p*
Totals........	203	526	966	328	483	358	125	278	6	1,198	1,930	1,175	7,676	947	25,167	726,386	43,364	30.50	10.57	29.05	33.12

REMARKS.

(*a*) Castle Garden and Emigrant Depot, 35.
(*b*) New York Hospital, 121.
(*c*) City Prison, 16; House of Industry, 1.
(*d*) St. Vincent's Hospital, 104; Jefferson Market Prison, 1.
(*e*) Essex Street Prison, 2.
(*f*) St. Francis's Hospital, 87.
(*g*) Ward's Island, 601; Randall's Island, 37; Bloomingdale Lunatic Asylum, 28; N.Y. Juvenile Asylum, 2; Deaf and Dumb Asylum, 3; Idiots' Asylum (R. I.), 1; House of Mercy, 2; House of Good Shepherd, 4; Colored Orphan Asyl., 8; Infants' Hosp., 709; House of Refuge, 4.
(*h*) R. C. Orphan Asylum, 1.
(*i*) Foundling Asylum, 32.
(*j*) St. Joseph's Home, 4.
(*k*) Eye Infirmary, 1.
(*l*) Home for Aged and Indigent Respectable Females, 3.
(*m*) City Lunatic Asylum, 121; Almshouse, 86; Penitentiary, 5; Small-pox, 49; Charity Hospital, 530; Epileptic and Paralytic Hospital, 31; Colored Home Hosp., 110; Nursery and Child's Hosp., 161; St. Luke's Hosp., 130; German Hosp., 13; Women's Hosp., 7; R. C. Orphan Asylum, 9; Inebriate Asylum, 3; Fever Hosp., 19; Workhouse, 19.
(*n*) Mount Sinai Hospital, 44.
(*o*) Bellevue Hospital, 906; Home of the Friendless, 14.
(*p*) N. Y. Orphan Asylum, 1.

Total in Public Institutions, 4,065.

The successive quarters of the year gave the following comparative results in the mortuary records:

DEATHS.	1st Quarter.	2d Quarter.	3d Quarter.	4th Quarter.
Total Number of Deaths	5,919	6,065	7,390	5,798
Deaths by Zymotic Diseases	1,347	1,776	3,158	1,396
Percentage of Deaths by Zymotic Diseases.	22.74	29.31	42.73	24.08

The winter quarter gives the least mortality by the zymotic diseases, and the fall quarter gives the next lowest. But in the first five months of the year there is the greatest excess of mortality by pulmonary diseases and the domestic pestilences, and especially by scarlatina and measles. The following abstract presents this fact in a statistical way:

DEATHS.	1st Quarter.	2d Quarter.	3d Quarter.	4th Quarter.
Deaths by Phthisis Pulmonalis	892	764	762	846
Other diseases of the Respiratory Organs	1,109	1,079	666	1,063
Total by Respiratory Diseases	2,001	1,843	1,428	1,909
Scarlatina	299	285	159	223
Measles	63	298	198	17

Although there may be no fixed law governing the season of prevalence of scarlatina and measles, there is certainly this law relating to the subject, namely, that their greatest fatality in our cities usually occurs in those months when the dwellings are least ventilated, and when the city is most unclean. There is reason to believe that these fatal scourges of child-life can be more effectually restrained by giving sanitary attention to household ventilation and purification, and by general and constant cleanliness, than by any other agencies which Boards of Health can direct.

Diseases of the respiratory organs are remarkably constant in the total mortality they cause in successive years; but, in the foregoing abstract, the fact is seen that the fluctuations of the line of aggregate mortality, from the acute and congestive kinds of these diseases, have wide range. Those fluctuations in the mortality line for this class of diseases seem greater than can be accounted for by the wide ranges of temperature during the same period, and it is probable that they are partly dependent upon other conditions than temperature.

The quantity of rain-fall in December was excessive, and rain fell copiously in eight days of the month, with a total precipitation of 5.79 inches' depth of water. There were but two rainy days in December, 1868, with 4.27 inches of water. The mean temperature of December was 34.63° Fahrenheit, whereas the mean in December, 1868, was 28.11°, a difference of 6.52°. The unusual moderation and humidity of the atmosphere, in December last, were associated with decidedly unhealthful conditions, and with an obstinate fatality in various diseases.

The mean temperature of the quarter was as mild as the average of the antumn months, but the amount of mortality by acute pulmonary diseases was somewhat greater than in the corresponding period in the previous three years, as shown in the following abstract:

QUARTER ENDING DECEMBER 31.	Mean Temperature.	Pneumonia and Bronchitis.	Total Acute Diseases of Respiratory Organs.	Phthisis.
1866....................	48°	508	696	825
1867....................	42°	589	777	887
1868....................	42°	593	742	787
1869....................	42°	752	888	946

REPORT ON MARRIAGE REGISTRATION.

Elisha Harris, M. D., *Sanitary Superintendent Metropolitan District:*

The most prominent fact to be found in the marriage registers for the year 1869 is the very great increase in the number of marriages registered. Whether this is the result of an increase in the number of marriages, as compared with previous years, or of a more general observation of the registry laws on the part of those who solemnize marriages, or of both these causes combined, does not very clearly appear from the data before us; but the fact is patent that the marriage registers for the past year contain 3,102 more names than those of any previous year since the organization of the Metropolitan Board of Health. To whatever cause it may be ascribed, the exhibit is exceedingly gratifying, and, in any event, betokens a healthy moral tone among the people of New York.

The following comparative table of the number of marriages registered during each of the four years that the Bureau of Vital Statistics has been under the control of the Metropolitan Board of Health, epitomizes the detailed tabular statements that precede this report, and will form the basis of such remarks upon the general subject of marriage registration as may seem judicious under existing circumstances:

YEARS.	Number of Marriages.	Foreign-born.		Native-born.		Nativity not stated.		No. of Persons married.
		Males.	Females.	Males.	Females.	Males.	Females.	Totals.
1866.........	5,792	3,659	3,428	1,351	1,588	782	776	11,584
1867.........	7,144	5,051	4,654	1,890	2,280	203	210	14,288
1868.........	6,926	4,818	4,398	1,963	2,387	145	141	13,852
1869.........	8,695	5,860	5,255	2,605	3,202	230	238	17,390

ABSTRACT OF THE REGISTRY OF MARRIAGES IN THE CITY OF NEW YORK FOR THE TWELVE MONTHS ENDING DECEMBER 31, 1869.

MONTHS.	TOTAL.	COLOR.		NATIVITY.						CONDITION.									
				FOREIGN.		NATIVE.		NOT STATED.		FIRST MARRIAGE.		SECOND MARRIAGE.		THIRD MARRIAGE.		FOURTH MARRIAGE.		NOT STATED.	
		White.	Black.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.
January	687	665	22	409	377	258	290	20	20	535	517	85	86	4	1	..	..	63	83
February	621	608	13	460	422	159	195	2	4	483	487	76	66	3	5	..	..	59	63
March	565	549	16	403	365	159	196	3	4	457	446	58	65	3	2	1	..	46	52
Total for the Quarter	1,873	1,822	51	1,272	1,164	576	681	25	28	1,475	1,450	219	217	10	8	1	..	168	198
April	883	857	26	520	458	320	383	43	42	684	691	114	94	4	4	1	..	80	94
May	832	811	21	580	518	248	309	4	5	661	677	89	80	7	4	1	..	74	71
June	709	682	27	487	426	221	282	1	1	588	596	86	76	6	3	..	..	29	34
Total for the Quarter	2,424	2,350	74	1,587	1,402	789	974	48	48	1,933	1,964	289	250	17	11	2	..	183	199
July	656	642	14	462	400	187	245	7	11	541	538	75	74	3	3	..	..	87	41
August	608	601	7	464	414	143	194	1	..	499	527	84	56	2	1	..	..	23	24
September	998	983	15	696	647	267	316	35	35	748	739	98	98	4	3	..	1	148	157
Total for the Quarter	2,262	2,226	36	1,622	1,461	597	755	43	46	1,788	1,804	257	228	9	7	..	1	208	222
October	620	607	13	420	366	196	250	4	4	490	508	86	58	4	1	1	..	39	53
November	822	809	13	494	437	227	281	101	104	607	588	109	116	5	6	..	..	101	112
December	694	682	12	465	425	220	261	9	8	551	567	88	75	7	2	..	..	48	50
Total for the Quarter	2,136	2,098	38	1,379	1,228	643	792	114	116	1,648	1,663	283	249	16	9	1	..	188	215
Grand Total for the Year	8,695	8,496	199	5,860	5,255	2,605	3,202	230	238	6,844	6,881	1,048	944	52	35	4	1	747	834

AGES OF PERSONS MARRIED.

MONTHS.	UNDER 20.		20-25.		25-30.		30-35.		35-40.		40-45.		45-50.		50-55.		55-60.		60-65.		65-70.		70-80.		NOT STATED.	
	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.
January	8	126	213	292	227	146	107	46	57	36	25	11	22	8	10	3	3	....	....	1	2	....	....	....	13	18
February	6	104	192	260	206	156	111	45	43	29	30	6	15	6	7	3	3	....	1	....	1	....	....	....	6	12
March	3	89	154	249	209	140	102	42	47	20	25	10	10	7	5	1	2	....	2	....	1	....	....	....	5	7
Total for the Quarter	17	319	559	801	642	442	320	133	147	85	80	27	47	21	22	7	8	....	3	1	4	....	....	....	24	37
April	7	154	250	388	315	177	150	76	66	45	42	15	26	14	10	3	3	....	5	....	2	1	....	....	7	10
May	4	140	231	377	309	195	142	54	66	36	34	10	19	5	10	4	4	1	2	....	1	....	1	....	9	10
June	3	120	229	313	231	166	118	54	53	29	31	12	19	5	12	2	1	2	1	....	3	....	....	....	8	6
Total for the Quarter	14	414	710	1078	855	538	410	184	185	110	107	37	64	24	32	9	8	3	8	....	6	1	1	....	24	26
July	4	99	196	293	222	144	105	57	57	31	29	17	19	1	8	4	7	1	2	1	1	....	....	....	6	8
August	6	121	194	256	192	133	104	51	56	21	25	14	12	4	9	2	7	....	....	....	1	....	1	2	1	4
September	7	141	264	385	303	209	151	79	74	28	33	15	22	7	3	1	7	2	3	....	....	2	1	....	130	129
Total for the Quarter	17	361	654	934	717	486	360	187	187	80	87	46	53	12	20	7	21	3	5	1	2	2	2	2	137	141
October	5	113	148	257	249	136	97	49	46	27	32	14	15	5	9	....	2	1	4	....	....	....	1	....	12	18
November	5	142	228	338	290	185	140	57	69	43	27	29	26	5	12	3	8	1	....	....	1	....	1	....	15	19
December	9	124	194	302	242	159	115	47	58	25	33	15	16	10	11	....	4	1	2	1	1	1	....	....	9	9
Total for the Quarter	19	379	570	897	781	480	352	153	173	95	92	58	57	20	32	3	14	3	6	1	2	1	2	....	36	46
Grand Total for the Year	67	1,473	2,493	3,710	2,995	1,946	1,442	657	692	370	366	168	221	77	106	26	51	9	22	3	14	4	5	2	221	250

The Marriage-Rate.—For the purpose of stating the marriage-rate accurately, two things are needed, namely, a trustworthy census of the population, and the certainty that all the marriages solemnized during the year have been registered. Unfortunately, neither of these things is at hand. Indeed, it is quite certain that marriages have taken place which do not appear on the public registers, although we have reason to believe that the number is gradually diminishing year by year. On the other hand, it is also true that the population of New York is not actually known. Nevertheless, for the purpose of comparison, no harm will be done if the marriage-rate be calculated upon the basis of the number of marriages registered, and the population of the island estimated at 1,000,000 persons.

During the year 1869 the names of 17,390 persons were placed upon the marriage registers, against 13,852 in the previous year, 14,288 in 1867, and 11,584 in 1866. This, upon the basis above named, is equivalent to an annual marriage-rate of 17.39, 13.85, 14.28, and 11.58 in one thousand inhabitants in each of the four years in the order in which they are named.

The evidences of deficiencies in the marriage registers have been so fully discussed in previous annual reports from the Bureau of Vital Statistics that it would seem to be unnecessary to allude to them again. But the best law can be of no value until it is enforced. And the fact, that nowhere in the State of New York, outside the Metropolitan District, is the least effort made to enforce the law requiring the registration of marriages, is rather disgraceful than otherwise. It is the duty of the State to secure to its citizens all the rights, benefits, and privileges, that may accrue to them from complete and accurate registration of marriages, births, and deaths, and, if it fails in this, it fails in a most important service. Elsewhere, in this State, the laws relating to birth and marriage registration are almost wholly neglected, and it does not therefore seem strange that, even here, some of those who are required to make such returns also neglect their duty under the law. The registration law is mandatory in its very nature; and, although penalties are threatened if the provisions of the law are disobeyed, no one of the many hundreds who are guilty of disobedience has ever yet been punished.

It would be well if legislators would inquire whether there is not something in the law itself which has a tendency to defeat its purpose. For instance, the officiating magistrate or clergyman, in case of marriage, is made responsible for the proper identification of the persons married, the suitableness of their ages, and for correct returns. In the very nature of things there is an almost insurmountable obstacle in the way of eliciting these facts, particularly if the parties have a special reason for hiding them, which not infrequently happens. But, if an ante-nuptial license were required to be returned to the Bureau of Registration after the ceremony was performed, and exchanged for a certificate of marriage, there would be a certainty of accuracy in the returns, and a safeguard for society and the rights of individuals that seem to be impossible under existing laws.

The value of this kind of vital registration has come to be very generally appreciated; but there is no provision against those neglects of duty to which all persons are liable, but more especially those whose duties are so manifold as the members of the profession that is expected to make these returns. Disguise it as we may, a duty imposed upon any class of persons which belongs exclusively to the State will not be willingly borne, and, where shirking is possible, if this can be done without great discredit, the temptation will not be resisted even by a clergyman or a magistrate. And here the truth might as well be stated, that whereas the benefit to be derived from this kind of vital registration pertains to the State as well as to the individual, and whereas the individual is almost sure to neglect his duty, it behooves the State to be so much the more vigilant, and, for the purpose of making the returns an absolute certainty, it should secure them by paying suitable persons a stipulated sum for collecting them and bringing them in. Experience elsewhere has proved this to be the only method in which entire completeness and accuracy can be had in the matter of births, and in respect of marriage, ante-nuptial licenses, together with the system of collecting them if they fail to be returned voluntarily, would effectually overcome the deficiencies against which so much complaint has been made.

The success of the Bureau of Vital Statistics in securing these returns is believed to have been unprecedented. Every thing that could be done through watchfulness and care to render these statistics accurate and complete has been accomplished. In many instances vouchers have been returned for correction, and in no case has an incomplete voucher been accepted, if painstaking inquiry could fill up the deficiencies. The result of this labor may be seen in the tabulated statements herewith presented, and in the records of each marriage as it stands upon the registers. For all of this much credit is due to the clergymen and magistrates who, during the past year, have performed marriage ceremonies. Between them and the officers of this Bureau the relations are of the most cordial character, and their faithfulness in making returns renders a mention of the fact and a courteous recognition of their endeavors to comply with the requirements of the Board not less agreeable as a personal pleasure than as a public duty.

Proportion of Marriages among the Native and Foreign-born Population.—The fluctuations in the marriage-rate, during the period covered by the above table, have been invariably followed by like fluctuations in the number of the foreign-born population whose names have been placed upon the marriage registers. But among the native-born men and women so registered there has been a constant increase. The fact is admirably shown in the following statistical statement of the nativities of the persons married and registered during the past four years:

NATIVITY.	1866.		1867.		1868.		1869.		TOTALS.
	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.	
Foreign........	3,659	3,428	5,051	4,654	4,818	4,398	5,860	5,255	37,123
Native........	1,351	1,588	1,890	2,280	1,963	2,387	2,605	3,202	17,266
Not stated.....	782	776	203	210	145	141	230	238	2,725

The steadily-increasing number of native-born men and women whose names find their way to the marriage registers is not the least of the many gratifying facts to be found in these records. In nearly all the European countries this kind of vital registration is guarded with great care; here the system is almost wholly voluntary, and has not been in practice long enough to have made it a habit among the people. This difference in custom explains nearly all the deficiency among the native-born, and discloses the class of the population among whom neglect of the registry law is most common. But the figures also show a wholesome advance in the popular sentiment in regard to the advantages to be derived from having this important contract and sacrament properly registered. The identification of the family and the rights of children to their names and property very often depend upon the accuracy of these registers. Of the economical and political advantages to be derived from these statistics no mention need be made.

During the four years ending December 31, 1869, the names of 37,123 persons who were foreign-born were placed upon the marriage registers, of whom 19,388 were males, and 17,735 were females. In the same period 17,266 names of native-born men and women—7,809 of the former and 9,457 of the latter—were also registered. In the registry of 1,360 men and 1,365 women the nativity was not stated. The figures show that 1,648 native women married foreign husbands, and that 1,653 foreign males married native wives, during the four years. Now, if we assume that about as many native as foreign-born men and women marry year by year, in New York, an estimate not very far from the truth, and take the average of the past four years as a standard, we find that the marriage-rate should be increased from 14.27 in one thousand inhabitants annually to 18.56 in one thousand. Now, as the number of persons married last year and registered was 17,390, it is clear that the deficiency amounts to 1,170 names, or in other words there were 585 marriages solemnized during the year in the city of New York that were not registered. The calculation might be made still more accurate by extending the time and correcting it for the number whose nativity was not stated; but it is sufficient to show that there is a deficiency, and also that some persons, we know not whom, have been neglecting their duty under the registry laws. Nevertheless, there is a gradual and constantly-increasing respect for the moral as well as the legal obligations to obey these requirements. This fact is conclusively proved thus: During nearly twenty years prior to the organization of the Metropolitan Board of Health only 49,131 marriages were registered in the city of New York; during the four years that have elapsed since that time, 28,557 marriages have been registered. It is believed that no better evidence of the value of the means adopted by the Board of Health to secure completeness and accuracy in the returns of marriages will be required than are presented in these simple statistical statements, and no greater degree of success need be expected in the future than has been achieved in the past under a system which not only divides the responsibility for making the returns, but also makes no provision for the execution of its own behests. The delinquents are proved to be native-born; their number is approximately stated; it now remains to find the parties who are delinquent and inflict the penalty. This possibly will not be done, although no one can doubt that the law which is enforced is the one that is treated with the greatest respect.

The Accuracy of the Returns.—In the year 1866 the number of persons married whose names were placed upon the registry, and whose nativity was not stated, was 13.45 per centum of the whole. In 1867 it was 2.86 per centum; in 1868 the proportion fell to a minimum which was 2.10. During the past year in this respect the percentage was 2.67, a very slight increase over the preceding twelvemonth.

Thus, from whatever point of view these statistics are seen, the result is alike gratifying. The very high standard of accuracy and completeness which was adopted from the first by the Metropolitan Board of Health has produced its legitimate result, not only in the comprehensive registration of those facts in each branch of vital statistics which are held to be of the greatest value to statists, but also in the respect that is shown for these methods both in this country and in Europe. At home, nearly every great city in the country has adopted these methods and pursues the system that was begun in New York, while abroad the vital statistics registered under the Metropolitan Board of Health take rank with those of England, France, and Prussia, in the value and completeness of the individual returns. To have achieved so much in so short a space of time is creditable alike to the Board and to those who make the original returns for registration.

If we shall succeed in preventing this department of vital registration from falling below the present standard of exactness, and if we shall, by any means, succeed in bringing in, year by year, the proportion that is now deficient, it will be a success that has never yet been achieved elsewhere, and a result that could scarcely be expected here. Increased efforts to educate the people of the State in regard to the effect of these legal forms upon the moral and social well-being of society, and extended knowledge of the social and economical value of marriage registration, and a deeper conviction of the duty imposed upon those who are required by law to forward marriage returns, are only necessary to render this branch of registration so thoroughly complete and accurate as to be beyond the reach of the most captious critic.

Respectfully submitted:

JOHN BOWNE,
Register Clerk, Metropolitan Board of Health.

REGISTRATION OF BIRTHS IN THE YEAR 1869.

There were 13,947 births of living infants reported and registered in the twelve months. This exhibits an increase amounting to 1,275 over the total number recorded in New York in the previous year. But even this total of the registered births is not half equal to the number that failed to be reported and registered. The voluntary method of making returns of birth, as shown in our previous reports, cannot be expected to secure the registration of more than one-third of the total number of all the infants born during the year. Especially must this be true in the city of New York, where more than half of the births are in low social life that scarcely can provide medical attendance at accouchements, and thereby secure the benefits of a professional return of birth by a ian.

ABSTRACT OF THE REGISTRY OF MARRIAGES IN THE CITY OF NEW YORK, FOR THE TWELVE MONTHS ENDING DECEMBER 31, 1869.

MONTHS.	TOTAL.	COLOR.		NATIVITY.						CONDITION.									
				FOREIGN.		NATIVE.		NOT STATED.		FIRST MARRIAGE.		SECOND MARRIAGE.		THIRD MARRIAGE.		FOURTH MARRIAGE.		NOT STATED.	
		White.	Black.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.
January	687	665	22	409	377	258	290	20	20	535	517	85	86	4	1	..	..	63	83
February	621	608	13	460	422	159	195	2	4	483	487	76	66	3	5	..	..	59	63
March	565	549	16	403	365	159	196	3	4	457	446	58	65	3	2	1	..	46	52
Total for the Quarter	1,873	1,822	51	1,272	1,164	576	681	25	28	1,475	1,450	219	217	10	8	1	..	168	198
April	883	857	26	520	458	320	383	43	42	684	691	114	94	4	4	1	..	80	94
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June	709	682	27	487	426	221	282	1	1	588	596	86	76	6	3	..	..	29	34
Total for the Quarter	2,424	2,350	74	1,587	1,402	789	974	48	48	1,933	1,964	289	250	17	11	2	..	183	199
July	656	642	14	462	400	187	245	7	11	541	538	75	74	3	3	..	..	37	41
August	608	601	7	464	414	143	194	1	..	499	527	84	56	2	1	..	..	23	24
September	998	983	15	696	647	267	316	35	35	748	739	98	98	4	3	..	1	148	157
Total for the Quarter	2,262	2,226	36	1,622	1,461	597	755	43	46	1,788	1,804	257	228	9	7	..	1	208	222
October	620	607	13	420	366	196	250	4	4	490	508	86	58	4	1	1	..	39	53
November	822	809	13	494	437	227	281	101	104	607	588	109	116	5	6	..	..	101	112
December	694	682	12	465	425	220	261	9	8	551	567	88	75	7	2	..	..	48	50
Total for the Quarter	2,136	2,098	38	1,379	1,228	643	792	114	116	1,648	1,668	283	249	16	9	1	..	188	215
Grand Total for the Year	8,695	8,496	199	5,860	5,255	2,605	3,202	230	238	6,844	6,881	1,048	944	52	35	4	1	747	834

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The Marriage-Rate.—For the purpose of stating the marriage-rate accurately, two things are needed, namely, a trustworthy census of the population, and the certainty that all the marriages solemnized during the year have been registered. Unfortunately, neither of these things is at hand. Indeed, it is quite certain that marriages have taken place which do not appear on the public registers, although we have reason to believe that the number is gradually diminishing year by year. On the other hand, it is also true that the population of New York is not actually known. Nevertheless, for the purpose of comparison, no harm will be done if the marriage-rate be calculated upon the basis of the number of marriages registered, and the population of the island estimated at 1,000,000 persons.

During the year 1869 the names of 17,390 persons were placed upon the marriage registers, against 13,852 in the previous year, 14,288 in 1867, and 11,584 in 1866. This, upon the basis above named, is equivalent to an annual marriage-rate of 17.39, 13.85, 14.28, and 11.58 in one thousand inhabitants in each of the four years in the order in which they are named.

The evidences of deficiencies in the marriage registers have been so fully discussed in previous annual reports from the Bureau of Vital Statistics that it would seem to be unnecessary to allude to them again. But the best law can be of no value until it is enforced. And the fact, that nowhere in the State of New York, outside the Metropolitan District, is the least effort made to enforce the law requiring the registration of marriages, is rather disgraceful than otherwise. It is the duty of the State to secure to its citizens all the rights, benefits, and privileges, that may accrue to them from complete and accurate registration of marriages, births, and deaths, and, if it fails in this, it fails in a most important service. Elsewhere, in this State, the laws relating to birth and marriage registration are almost wholly neglected, and it does not therefore seem strange that, even here, some of those who are required to make such returns also neglect their duty under the law. The registration law is mandatory in its very nature; and, although penalties are threatened if the provisions of the law are disobeyed, no one of the many hundreds who are guilty of disobedience has ever yet been punished.

It would be well if legislators would inquire whether there is not something in the law itself which has a tendency to defeat its purpose. For instance, the officiating magistrate or clergyman, in case of marriage, is made responsible for the proper identification of the persons married, the suitableness of their ages, and for correct returns. In the very nature of things there is an almost insurmountable obstacle in the way of eliciting these facts, particularly if the parties have a special reason for hiding them, which not infrequently happens. But, if an ante-nuptial license were required to be returned to the Bureau of Registration after the ceremony was performed, and exchanged for a certificate of marriage, there would be a certainty of accuracy in the returns, and a safeguard for society and the rights of individuals that seem to be impossible under existing laws.

The value of this kind of vital registration has come to be very generally appreciated; but there is no provision against those neglects of duty to which all persons are liable, but more especially those whose duties are so manifold as facts to be found in these records. In nearly all the European countries this kind of vital registration is guarded with great care; here the system is almost wholly voluntary, and has not been in practice long enough to have made it a habit among the people. This difference in custom explains nearly all the deficiency among the native-born, and discloses the class of the population among whom neglect of the registry law is most common. But the figures also show a wholesome advance in the popular sentiment in regard to the advantages to be derived from having this important contract and sacrament properly registered. The identification of the family and the rights of children to their names and property very often depend upon the accuracy of these registers. Of the economical and political advantages to be derived from these statistics no mention need be made.

During the four years ending December 31, 1869, the names of 37,123 persons who were foreign-born were placed upon the marriage registers, of whom 19,388 were males, and 17,735 were females. In the same period 17,266 names of native-born men and women—7,809 of the former and 9,457 of the latter—were also registered. In the registry of 1,360 men and 1,365 women the nativity was not stated. The figures show that 1,648 native women married foreign husbands, and that 1,653 foreign males married native wives, during the four years. Now, if we assume that about as many native as foreign-born men and women marry year by year, in New York, an estimate not very far from the truth, and take the average of the past four years as a standard, we find that the marriage-rate should be increased from 14.27 in one thousand inhabitants annually to 18.56 in one thousand. Now, as the number of persons married last year and registered was 17,390, it is clear that the deficiency amounts to 1,170 names, or in other words there were 585 marriages solemnized during the year in the city of New York that were not registered. The calculation might be made still more accurate by extending the time and correcting it for the number whose nativity was not stated; but it is sufficient to show that there is a deficiency, and also that some persons, we know not whom, have been neglecting their duty under the registry laws. Nevertheless, there is a gradual and constantly-increasing respect for the moral as well as the legal obligations to obey these requirements. This fact is conclusively proved thus: During nearly twenty years prior to the organization of the Metropolitan Board of Health only 49,131 marriages were registered in the city of New York; during the four years that have elapsed since that time, 28,557 marriages have been registered. It is believed that no better evidence of the value of the means adopted by the Board of Health to secure completeness and accuracy in the returns of marriages will be required than are presented in these simple statistical statements, and no greater degree of success need be expected in the future than has been achieved in the past under a system which not only divides the responsibility for making the returns, but also makes no provision for the execution of its own behests. The delinquents are proved to be native-born; their number is approximately stated; it now remains to find the parties who are delinquent and inflict the penalty. This possibly will not be done, although no one can doubt that the law which is enforced is the one that is treated with the greatest respect.

The Accuracy of the Returns.—In the year 1866 the number of persons married whose names were placed upon the registry, and whose nativity was not stated, was 13.45 per centum of the whole. In 1867 it was 2.86 per centum; in 1868 the proportion fell to a minimum which was 2.10. During the past year in this respect the percentage was 2.67, a very slight increase over the preceding twelvemonth.

Thus, from whatever point of view these statistics are seen, the result is alike gratifying. The very high standard of accuracy and completeness which was adopted from the first by the Metropolitan Board of Health has produced its legitimate result, not only in the comprehensive registration of those facts in each branch of vital statistics which are held to be of the greatest value to statists, but also in the respect that is shown for these methods both in this country and in Europe. At home, nearly every great city in the country has adopted these methods and pursues the system that was begun in New York, while abroad the vital statistics registered under the Metropolitan Board of Health take rank with those of England, France, and Prussia, in the value and completeness of the individual returns. To have achieved so much in so short a space of time is creditable alike to the Board and to those who make the original returns for registration.

If we shall succeed in preventing this department of vital registration from falling below the present standard of exactness, and if we shall, by any means, succeed in bringing in, year by year, the proportion that is now deficient, it will be a success that has never yet been achieved elsewhere, and a result that could scarcely be expected here. Increased efforts to educate the people of the State in regard to the effect of these legal forms upon the moral and social well-being of society, and extended knowledge of the social and economical value of marriage registration, and a deeper conviction of the duty imposed upon those who are required by law to forward marriage returns, are only necessary to render this branch of registration so thoroughly complete and accurate as to be beyond the reach of the most captious critic.

Respectfully submitted:

JOHN BOWNE,
Register Clerk, Metropolitan Board of Health.

REGISTRATION OF BIRTHS IN THE YEAR 1869.

There were 13,947 births of living infants reported and registered in the twelve months. This exhibits an increase amounting to 1,275 over the total number recorded in New York in the previous year. But even this total of the registered births is not half equal to the number that failed to be reported and registered. The voluntary method of making returns of birth, as shown in our previous reports, cannot be expected to secure the registration of more than one-third of the total number of all the infants born during the year. Especially must this be true in the city of New York, where more than half of the births are in low social life that scarcely can provide medical attendance at accouchements, and thereby secure the benefits of a professional return of birth by a physician.

ABSTRACT OF THE REGISTRY OF BIRTHS IN THE CITY OF NEW YORK, IN THE TWELVE MONTHS ENDING DECEMBER 31, 1869.

MONTHS.	TOTAL.	COLOR.			SEX.			NATIVITY OF PARENTS.									NAME OF CHILD.	
												NATIVITY OF FATHER STATED ONLY.		NATIVITY OF MOTHER STATED ONLY.				
		White.	Colored.	Not stated.	Male.	Female.	Not stated.	Foreign.	Native.	Foreign Father only.	Foreign Mother only.	Native.	Foreign.	Native.	Foreign.	Not stated.	Stated.	Not stated.
January	1,224	1,203	21	....	633	590	1	797	220	110	46	1	1	5	43	1	993	231
February	1,075	1,062	13	....	565	508	2	676	224	77	46	....	1	6	45	....	676	399
March	1,440	1,426	14	....	740	698	2	958	250	121	58	....	2	9	42	....	1,020	420
Total, Quarter ending March 31	3,739	3,691	48	....	1,938	1,796	5	2,431	694	308	150	1	4	20	130	1	2,689	1,050
April	1,220	1,199	21	....	627	593	....	780	220	123	51	1	3	5	37	....	873	347
May	764	755	9	....	378	386	....	491	142	56	27	....	....	2	44	2	539	225
June	849	835	14	....	400	448	1	543	163	77	30	....	....	3	33	....	569	280
Total, Quarter ending June 30	2,833	2,789	44	....	1,405	1,427	1	1,814	525	256	108	1	3	10	114	2	1,981	852
July	1,103	1,094	9	....	587	515	1	752	175	106	34	2	....	4	30	....	811	292
August *	1,263	1,249	14	....	638	620	5	819	219	104	51	....	1	....	54	3	858	405
September †	1,484	1,465	19	....	764	719	1	976	239	128	67	....	....	6	58	2	1,100	384
Total, Quarter ending Sept. 30	3,850	3,808	42	....	1,989	1,854	7	2,547	633	338	152	2	1	10	142	5	2,769	1,081
October	1,027	1,010	17	....	494	532	1	632	193	103	44	....	1	6	47	1	713	314
November	1,241	1,221	20	....	624	617	....	838	208	108	42	....	....	6	38	1	943	298
December	1,257	1,236	21	....	646	609	2	818	204	114	59	1	1	7	51	2	850	407
Total, Quarter ending Dec. 31	3,525	3,467	58	....	1,764	1,758	3	2,288	605	325	145	1	2	19	136	4	2,506	1,019
Grand Total	13,947	13,755	192	....	7,096	6,835	16	9,080	2,457	1,227	555	5	10	59	522	12	9,945	4,002

* Ten twin-births and one triplet-birth during the month of August.

† Eight twin-births during the month of September.

NOTE.—The reports of twin-births in the first two quarters, and in the fourth quarter, were not specified.

RETURN OF STILLBIRTHS,

Showing the Nativity of Parents, and the Period of Utero-gestation, for the Twelve Months ending December 31, 1869.

MONTHS.	TOTAL.	SEX.			NATIVITY OF						PERIOD OF UTERO-GESTATION.										
					FATHER.			MOTHER.			MONTH.										
		Male.	Female.	Not stated.	Native.	Foreign.	Not stated.	Native.	Foreign.	Not stated.	First.	Second.	Third.	Fourth.	Fifth.	Sixth.	Seventh.	Eighth.	Ninth.	Tenth.	Not stated.
January	213	104	99	10	40	145	28	52	152	9	....	....	2	4	10	21	23	23	104	....	26
February	177	101	70	6	40	116	21	44	124	9	....	1	2	2	9	15	24	23	91	1	9
March	195	107	84	4	42	141	12	39	148	8	....	....	1	6	11	19	20	33	91	3	11
Total, 1st Quarter	585	312	253	20	122	402	61	135	424	26	....	1	5	12	30	55	67	79	286	4	46
April	175	95	80	....	35	115	25	44	116	15	....	....	2	4	13	19	30	15	69	2	21
May	185	108	77	....	40	133	12	43	136	6	....	....	....	5	11	21	34	26	78	1	9
June	188	122	66	....	35	134	19	38	139	11	....	1	....	7	17	11	34	23	75	....	20
Total, 2d Quarter	548	325	223	....	110	382	56	125	391	32	....	1	2	16	41	51	98	64	222	3	50
July	202	133	66	3	40	142	20	48	142	12	....	....	1	1	12	16	28	29	95	1	19
August	195	120	74	1	36	139	20	38	144	13	1	1	1	8	9	19	34	21	89	3	9
September	164	87	77	....	36	113	15	31	128	5	....	1	....	2	7	17	29	23	74	....	11
Total, 3d Quarter	561	340	217	4	112	394	55	117	414	30	1	2	2	11	28	52	91	73	258	4	39
October	171	101	70	....	42	109	20	51	106	14	....	....	....	3	11	14	22	21	81	2	17
November	171	94	77	....	26	131	14	36	132	3	....	....	1	3	5	7	33	30	87	1	4
December	179	104	74	1	35	133	11	38	135	6	....	1	2	5	7	14	23	16	99	1	11
Total, 4th Quarter	521	299	221	1	103	373	45	125	373	23	....	1	3	11	23	35	78	67	267	4	32
Grand Total	2,215	1,276	914	25	447	1,551	217	502	1,602	111	1	5	12	50	122	193	334	283	1,033	15	167

CONSOLIDATED ABSTRACT OF THE RECORDS OF MORTALITY FOR THE YEAR 1869.

The form of abstract that has been adopted in the reports of the preceding three years is continued, as it serves all purposes well. This abstract, like that in the report for 1868, comprises the total records of mortality in the calendar year, and concludes with a condensed summary of the classified records of the successive years (a period of four years) in which the Metropolitan Board of Health has had charge of the registration of vital statistics. Still-birth records are not included in this abstract, but, as in previous years, are treated as a special class of deaths that require a separate registration and a special study by the sanitary officers and vital statisticians.

No attempt is made to study the fluctuations of the death-rate in connection with the rates of increase in city population. A correct census by the national Government must precede such a study. But, basing our estimate of the death-rate upon 1,000,000—the common estimation for the New York City population—the death-rate in this city in the year 1869 was 25.16 deaths to every 1,000 inhabitants. The death-rate in Brooklyn was 20.91, estimating its population at 400,000.* We place the consolidated abstracts of the Brooklyn mortality in immediate connection following those for New York:

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* This estimation for Brooklyn is given by Dr. R. C. Stiles, the Assistant-Sanitary Superintendent.

CONSOLIDATED ABSTRACTS OF DEATHS IN NEW YORK, FROM ALL CAUSES, REGISTERED FOR THE TWELVE MONTHS ENDING DECEMBER 31, 1869.

MALES.

CAUSES OF DEATH.	NATIVITY.		Colored.	Under 1 year.	1-	2-	3-	4-	Total under 5 years.	5-	10-	15-	20-	25-	30-	35-	40-	45-	50-	55-	60-	65-	70-	75-	80-	85-	90-	95-	100 and upward.	TOTAL MALES.
	United States.	Foreign.																												
Class I.																														
ZYMOTIC DISEASES.																														
ORDER 1. (*Miasmatic Diseases.*)																														
Small-pox	73	31	1	19	18	11	7	4	59	7	2	3	3	13	4	4	2	1	4	1	....	....	1	....	....	....	....	....	....	104
Varicella	2	....	....	2	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Measles	238	33	....	74	102	47	27	9	259	11	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	271
Scarlatina	446	42	1	36	105	112	76	58	387	77	11	5	5	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	488
Diphtheria	147	11	....	21	41	35	21	16	134	18	1	....	1	....	1	....	....	3	....	....	....	....	....	....	....	....	....	....	....	158
Croup (Membranous)	246	9	2	45	69	58	40	22	234	21	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	255
Quinsy (Tonsillitis)	5	1	....	1	1	1	1	....	4	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	6
Whooping-cough	147	5	2	74	46	13	7	6	146	6	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	152
Typhus Fever	16	66	....	....	....	....	....	2	2	5	4	7	13	8	7	7	9	6	7	5	2	....	....	....	....	....	....	....	....	82
Typhoid Fever	70	140	2	1	2	3	8	3	17	19	13	20	30	20	16	11	15	10	7	8	11	8	1	2	1	....	....	1	....	210
Erysipelas	61	21	1	45	6	....	....	1	52	....	....	....	1	2	2	4	5	4	2	2	2	1	1	3	....	1	....	....	....	82
Pyæmia	25	20	....	1	....	1	....	1	3	1	5	3	2	6	6	5	3	2	4	1	2	2	....	....	....	....	....	....	....	45
Septicæmia	4	1	....	2	....	....	....	....	2	....	....	....	....	2	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	5
Dysentery	86	97	1	39	20	7	8	6	80	12	4	2	10	4	12	7	13	3	5	3	10	6	6	4	2	....	....	....	....	183
Diarrhœa	531	136	7	379	132	28	10	9	558	7	7	3	5	5	8	10	8	10	12	9	7	4	3	3	4	2	2	....	....	667
Cholera (Asiatic)	2	3	....	....	....	....	....	....	....	....	....	....	1	....	....	1	....	1	....	....	1	1	....	....	....	....	....	....	....	5
Cholera Morbus	6	8	1	1	1	....	1	....	3	1	....	1	....	1	1	2	1	....	....	2	1	....	....	1	....	....	....	....	....	14
Cholera Infantum	616	13	8	459	145	18	4	1	627	1	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	629
Entero-Colitis	182	2	4	157	20	3	1	1	182	1	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	184
Cerebro-spinal Meningitis	15	3	....	6	3	2	....	....	11	1	2	....	1	....	1	....	....	....	....	....	1	....	....	1	....	....	....	....	....	18
Remittent Fever	41	21	2	5	5	1	7	3	21	9	2	2	....	7	2	4	3	3	4	1	....	2	....	2	....	....	....	....	....	62
Intermittent Fever	4	1	....	....	....	1	....	....	1	1	....	....	....	1	....	....	....	1	1	....	....	....	....	....	....	....	....	....	....	5
Yellow Fever	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Total Miasmatic Diseases	2963	665	32	1367	716	341	218	142	2784	200	52	47	72	72	60	57	59	44	47	32	37	24	12	16	7	3	2	1	....	3628

FEMALES.

CAUSES OF DEATH.	NATIVITY.		Colored.	Under 1 year.	1-	2-	3-	4-	Total under 5 years.	5-	10-	15-	20-	25-	30-	35-	40-	45-	50-	55-	60-	65-	70-	75-	80-	85-	90-	95-	100 and upward.	TOTAL FEMALES.	TOTAL BOTH SEXES.	Percentage of each cause on Total.
	United States.	Foreign.																														
Class I.																																
ZYMOTIC DISEASES.																																
ORDER 1. (*Miasmatic Diseases*).																																
Small-pox	80	19	1	28	13	9	9	9	68	10	1	3	10	5	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	99	203	.81
Varicella	3	....	....	1	2	....	....	....	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3	5	.02
Measles	216	39	....	62	95	39	24	11	231	20	....	1	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	255	526	2.09
Scarlatina	446	32	2	47	92	86	78	59	362	93	13	2	3	3	1	....	1	....	....	....	....	....	....	....	....	....	....	....	....	478	966	3.84
Diphtheria	153	17	....	25	45	27	25	16	138	25	1	1	....	2	....	1	1	1	....	....	....	....	....	....	....	....	....	....	....	170	328	1.30
Croup (Membranous)	225	3	1	43	56	42	38	28	207	21	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	228	483	1.92
Quinsy (Tonsillitis)	2	1	....	1	....	....	....	....	1	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3	9	.04
Whooping-cough	202	4	4	98	63	23	9	7	200	6	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	206	358	1.42
Typhus Fever	19	24	....	....	1	....	1	1	3	5	4	8	6	1	4	1	2	3	1	1	1	2	1	....	....	....	....	....	....	43	125	.50
Typhoid Fever	64	104	3	....	....	2	4	5	11	14	11	22	23	14	15	10	12	7	8	8	5	5	2	1	....	....	....	....	....	168	378	1.50
Erysipelas	58	12	....	47	3	....	....	....	50	....	1	....	3	2	1	....	1	1	2	3	1	2	1	1	....	....	1	....	....	70	152	.60
Puerperal Fever	12	43	1	....	....	....	....	....	....	....	....	4	10	13	14	10	4	....	....	....	....	....	....	....	....	....	....	....	....	55	55	.22
Pyæmia	9	22	....	3	2	....	....	....	5	....	....	1	6	6	4	5	1	....	1	1	1	....	....	....	....	....	....	....	....	31	76	.30
Septicæmia	1	3	....	....	....	....	....	1	1	....	....	....	....	1	....	....	1	1	....	....	....	....	....	....	....	....	....	....	....	4	9	.04
Dysentery	87	73	2	31	30	4	2	5	72	3	4	2	6	7	5	10	8	3	8	7	7	7	3	3	3	1	1	....	....	160	343	1.36
Diarrhœa	443	118	10	301	116	24	10	10	461	5	....	6	8	7	7	8	10	4	7	9	7	3	8	7	2	1	....	1	....	561	1228	4.88
Cholera (Asiatic)	......	1	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	6	.02
Cholera Morbus	11	23	2	1	1	2	....	....	4	3	....	1	....	2	3	2	3	2	5	2	3	2	....	1	1	....	....	....	....	34	48	.19
Cholera Infantum	562	7	7	416	128	22	2	1	569	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	569	1198	4.76
Entero-Colitis	121	6	....	101	16	1	1	1	120	1	....	1	1	1	....	....	2	....	1	....	....	....	....	....	....	....	....	....	....	127	311	1.24
Cerebro-spinal Meningitis	20	4	....	10	2	3	1	1	17	....	1	1	2	1	....	....	1	1	....	....	....	....	....	....	....	....	....	....	....	24	42	.17
Remittent Fever	33	14	3	4	5	2	....	4	15	6	3	1	2	2	3	1	....	1	....	5	3	5	....	....	....	....	....	....	....	47	109	.43
Intermittent Fever	8	6	....	2	3	1	....	....	6	2	....	1	1	....	1	....	....	1	1	....	....	....	1	....	....	....	....	....	....	14	19	.08
Yellow Fever	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	.004
Total Miasmatic Diseases	2775	575	36	1221	673	287	204	159	2544	216	39	55	84	68	60	48	47	25	34	36	28	26	16	13	6	2	2	1	....	3350	6978	27.73

DEATHS IN NEW YORK—Continued.

CAUSES OF DEATH.	MALES.																													
	NATIVITY.																													
	United States.	Foreign.	Colored.	Under 1 year.	1-	2-	3-	4-	Total under 5 years.	5-	10-	15-	20-	25-	30-	35-	40-	45-	50-	55-	60-	65-	70-	75-	80-	85-	90-	95-	100 and upward.	TOTAL MALES.
***Class I.**—Continued.*																														
ORDER 2. (*Enthetic and Inoculated Diseases.*)																														
Syphilis	33	5	3	30	1	....	....	....	31	....	....	1	1	1	2	1	1	....	....	....	....	....	....	....	....	....		....	....	38
Gangrene	1	7	....	......	....	....	....	....	......	....	....	1	....	1	....	....	2	....	1	1	1	1	....	....	....	....	....	....	....	8
Porrigo favosa	1	......	....	1	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Impetigo (Malignant Pustule)	1	1	....	......	....	....	....	....	......	....	....	....	....	....	....	....	....	1	....	1	....	....	....	....	....	....	....	....	....	2
Glanders	......	1	....	......	....	....	....	....	......	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	1
Hydrophobia	3	2	....	......	....	1	....	....	1	1	1	....	....	....	....	....	....	....	....	....	1	1	....	....	....	....	....	....	....	5
Total Enthetic and Inoculated Diseases.	39	16	3	31	1	1	....	....	33	1	1	2	1	2	2	1	3	2	1	2	2	2	....	....	....	....	....	....	....	55
ORDER 3. (*Dietic Diseases.*)																														
Inanition	142	6	6	143	....	2	....	....	145	....	....	1	....	1	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	148
Want of Breast Milk	5	......	....	5	....	....	....	....	5	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	5
Purpura	12	1	....	7	1	....	1	....	9	1	....	1	1	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	13
Alcoholism. *a* Intemperance	33	81	1	......	....	....	....	....	......	....	....	....	3	15	14	24	14	9	15	7	5	5	....	....	....	....	....	....	....	111
Alcoholism. *b* Del. Tremens.	19	51	....	......	....	....	....	....	......	....	....	1	3	8	14	11	11	11	4	3	1	2	1	....	....	....	....	....	....	70
Total Dietic Diseases	208	139	7	155	1	2	1	....	159	1	....	3	7	24	30	35	25	20	19	10	6	7	1	....	....	....	....	....	....	347
ORDER 4. (*Parasitic Diseases.*)																														
Trichinosis	......	2	....	......	....	....	....	....	......	....	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Total Parasitic Diseases	......	2	....	......	....	....	....	....	......	....	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Total Zymotic Class	**3210**	**822**	**42**	**1553**	**718**	**344**	**219**	**142**	**2976**	**202**	**53**	**52**	**80**	**98**	**94**	**93**	**87**	**66**	**67**	**44**	**45**	**33**	**13**	**16**	**7**	**3**	**2**	**1**	......	**4032**

FEMALES.

CAUSES OF DEATH.	Nativity.		Colored.	Under 1 year.	1-	2-	3-	4-	Total under 5 years.	5-	10-	15-	20-	25-	30-	35-	40-	45-	50-	55-	60-	65-	70-	75-	80-	85-	90-	95-	100 and upward.	Total Females.	Total both Sexes.	Percentage of each cause on Total.
	United States.	Foreign.																														
Class I.—Continued.																																
ORDER 2. (*Enthetic and Inoculated Diseases.*)																																
Syphilis	35	4	3	31	1	....	....	....	32	....	....	1	....	3	....	1	...	1	1	....	....	....	....	....	...	....	....	....	....	39	77	.31
Gangrene	3	....	....	1	....	....	....	....	1	1	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	3	11	.04
Porrigo favosa	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	...	....	....	....	....	....	....	....	....	....	...	1	.004
Impetigo (Malignant Pustule)	1	1	....	....	....	1	....	....	1	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	2	4	.02
Glanders	....	....	....	....	....	....	....	....	....	....	....	...	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	.004
Hydrophobia	....	....	...	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	5	.02
Total Enthetic and Inoculated Diseases	39	5	3	32	1	1	....	....	34	1	....	1	....	3	....	3	....	1	1	....	....	...	....	....	....	....	....	....	....	44	99	.39
ORDER 3. (*Dietic Diseases.*)																																
Inanition	135	9	1	132	7	....	....	....	139	....	....	....	....	....	....	1	....	....	....	1	....	....	2	....	....	....	....	....	1	144	292	1.17
Want of Breast Milk	4	....	....	4	....	....	....	....	4	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4	9	.04
Purpura	4	1	....	1	1	....	1	....	3	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	5	18	.07
Alcoholism. *a* Intemperance	11	70	....	....	....	....	....	....	....	....	....	....	8	8	17	15	13	8	7	1	2	1	....	1	....	....	....	....	....	81	192	.76
Alcoholism. *b* Del. Tremens	1	15	....	....	....	....	....	....	....	....	....	....	4	....	2	3	3	1	3	....	....	....	....	....	....	....	....	....	....	16	86	.34
Total Dietic Diseases	155	95	1	137	8	....	1	....	146	....	....	....	14	8	19	19	16	9	10	2	2	1	2	1	....	....	....	....	1	250	597	2.37
ORDER 4. (*Parasitic Diseases.*)																																
Trichinosis	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	.01
Total Parasitic Diseases	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	.01
Total Zymotic Class	**2969**	**675**	**40**	**1390**	**682**	**288**	**205**	**159**	**2724**	**217**	**39**	**56**	**98**	**79**	**79**	**70**	**63**	**35**	**45**	**38**	**30**	**27**	**18**	**14**	**6**	**2**	**2**	**1**	**1**	**3644**	**7676**	**30.50**

DEATHS IN NEW YORK—Continued.

CAUSES OF DEATH.	MALES.																													
	NATIVITY.		Colored.	Under 1 year.	1-	2-	3-	4-	Total under 5 years.	5-	10-	15-	20-	25-	30-	35-	40-	45-	50-	55-	60-	65-	70-	75-	80-	85-	90-	95-	100 and upward.	TOTAL MALES.
	United States.	Foreign.																												
Class II.																														
CONSTITUTIONAL DISEASES.																														
ORDER 1. (*Diathetic Diseases.*)																														
Gout	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	1
Rheumatism	16	15	....	....	....	....	....	....	....	2	1	3	1	2	1	....	2	5	4	3	....	4	1	2	....	....	....	....	....	31
Dropsy	53	54	2	1	3	4	5	7	20	13	5	2	....	2	6	6	6	5	11	6	9	8	5	1	1	1	....	....	....	107
Cancer	13	23	....	....	....	1	....	....	1	....	....	....	1	3	....	5	6	4	2	3	2	4	3	2	....	....	....	....	....	36
" of Eye	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	1	....	....	....	....	....	....	....	....	....	....	....	2
" of Face	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	....	....	2
" of Liver	2	11	....	....	....	....	....	....	....	....	....	....	....	....	....	1	2	2	3	2	2	1	....	....	....	....	....	....	....	13
" of Mouth	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	1
" of Rectum	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	1
" of Stomach	3	19	....	....	....	....	....	....	....	....	....	....	....	1	....	1	1	3	3	3	6	4	....	....	....	....	....	....	....	22
" of Tongue	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	1
Noli me tangere	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	1
Noma (Cancrum Oris)	5	....	....	2	...	3	....	....	5	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	5
Total Diathetic Diseases	97	126	2	3	3	8	5	7	26	15	6	5	2	8	7	14	17	21	24	17	19	23	11	5	1	2	....	....	....	223
ORDER 2. (*Tubercular Diseases.*)																														
Scrofula	21	3	....	16	3	1	....	....	20	2	....	1	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	24
Lumbar Abscess (Psoas, etc.)	3	3	....	....	....	....	....	....	....	3	....	1	....	1	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	6
Tabes Mesenterica	451	36	11	335	84	23	6	4	452	2	2	2	1	....	....	....	1	3	1	3	5	6	3	2	2	2	....	....	....	487
Phthisis Pulmonalis	528	1220	58	2	22	14	9	5	52	25	17	71	199	233	237	203	184	141	115	86	77	51	34	16	6	1	....	....	....	1748
Hydrocephalus	364	8	7	168	118	43	13	10	352	14	4	....	....	1	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	372
Tubercular Meningitis	35	2	1	10	9	9	1	....	29	5	1	....	....	....	1	....	....	1	....	....	....	....	....	....	....	....	....	....	....	37
Total Tubercular Diseases	1402	1272	77	531	236	90	29	19	905	51	24	75	200	235	239	203	185	145	117	89	82	57	37	19	8	3	....	....	....	2674
Total Constitutional Class	**1499**	**1398**	**79**	**534**	**239**	**98**	**34**	**26**	**931**	**66**	**30**	**80**	**202**	**243**	**246**	**217**	**202**	**166**	**141**	**106**	**101**	**80**	**48**	**24**	**9**	**5**	....	....	....	**2897**

FEMALES.

CAUSES OF DEATH.	NATIVITY. United States.	NATIVITY. Foreign.	Colored.	Under 1 year.	1-	2-	3-	4-	Total under 5 years.	5-	10-	15-	20-	25-	30-	35-	40-	45-	50-	55-	60-	65-	70-	75-	80-	85-	90-	95-	100 and upward.	TOTAL FEMALES.	TOTAL BOTH SEXES.	Percentage of each cause on Total.
Class II.																																
CONSTITUTIONAL DISEASES.																																
ORDER 1. (*Diathetic Diseases.*)																																
Gout	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	.004
Rheumatism	7	19	1	....	....	....	....	....	....	2	....	1	....	1	2	2	3	1	2	....	6	4	....	1	1	....	....	....	....	26	57	.23
Dropsy	42	81	3	2	1	1	4	2	10	9	2	3	3	7	3	10	11	12	10	8	9	6	13	6	....	1	....	....	....	123	230	.92
Cancer	4	14	....	....	....	....	....	....	....	....	....	....	....	1	....	3	1	3	4	1	3	1	....	1	....	....	....	....	....	18	54	.21
" of Breast	13	36	....	....	....	....	....	....	....	....	....	....	....	1	....	4	11	6	8	8	5	3	....	3	....	....	....	....	....	49	49	.19
" of Eye	2	2	1	....	....	....	....	1	1	....	....	....	....	....	....	....	....	....	....	....	....	2	....	1	....	....	....	....	....	4	6	.02
" of Face	....	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	1	1	....	....	....	....	....	....	3	5	.02
" of Liver	....	17	....	....	....	....	....	....	....	....	....	....	....	1	2	2	2	1	4	1	1	1	2	....	....	....	....	....	....	17	30	.12
" of Mouth	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	.004
" of Nose	....	1	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	.004
" of Rectum	4	1	....	....	....	....	....	....	....	....	....	....	....	....	....	2	1	....	....	1	....	....	....	1	....	....	....	....	....	5	6	.02
" of Stomach	11	25	4	....	....	....	....	....	....	....	....	....	....	2	....	2	7	4	5	4	4	2	2	3	1	....	....	....	....	35	57	.23
" of Tongue	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	1	2	.01
" of Uterus	22	70	1	....	....	....	....	....	....	....	....	....	1	2	6	8	15	18	18	7	5	8	4	....	....	....	....	....	....	92	92	.36
Noli me tangere	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	1	2	.01
Exophthalmia	....	1	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	.004
Noma (Cancrum Oris)	5	....	....	1	1	2	....	1	5	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	5	10	.04
Total Diathetic Diseases	111	271	10	3	2	3	4	4	16	11	2	4	4	15	15	33	54	45	51	30	33	28	22	16	2	1	....	....	....	382	605	2.40
ORDER 2. (*Tubercular Diseases.*)																																
Scrofula	23	1	....	10	5	3	1	1	20	1	....	....	1	1	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	24	48	.19
Lumbar Abscess (Psoas, etc.)	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	1	7	.03
Tabes Mesenterica	401	42	15	285	95	23	6	1	410	4	1	....	1	1	1	....	....	....	....	1	3	5	5	2	5	....	4	....	....	443	930	3.69
Phthisis Pulmonalis	518	1098	58	4	21	16	8	5	54	18	22	93	241	243	188	216	149	112	68	56	50	47	32	16	8	....	2	1	....	1616	3364	13.39
Hydrocephalus	310	6	7	146	100	40	9	6	301	13	1	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	316	688	2.73
Tubercular Meningitis	38	3	2	11	12	7	3	2	35	3	1	....	....	....	....	1	....	1	....	....	....	....	....	....	....	....	....	....	....	41	78	.31
Total Tubercular Diseases	1290	1151	82	456	233	89	27	15	820	39	25	93	244	245	189	218	149	113	69	60	55	52	34	21	8	4	2	1	....	2441	5115	20.32
Total Constitutional Class	**1401**	**1422**	**92**	**459**	**235**	**92**	**31**	**19**	**836**	**50**	**27**	**97**	**248**	**260**	**204**	**251**	**203**	**158**	**120**	**90**	**88**	**80**	**56**	**37**	**10**	**5**	**2**	**1**	......	**2823**	**5720**	**22.73**

DEATHS IN NEW YORK—Continued.

CAUSES OF DEATH.	MALES.																													
	NATIVITY.		Colored.	Under 1 year.	1-	2-	3-	4-	Total under 5 years.	5-	10-	15-	20-	25-	30-	35-	40-	45-	50-	55-	60-	65-	70-	75-	80-	85-	90-	95-	100 and upward.	TOTAL MALES.
	United States.	Foreign.																												
Class III.																														
LOCAL DISEASES.																														
ORDER 1. (*Nervous Diseases.*)																														
Meningitis	350	47	13	132	90	41	17	17	297	24	13	8	8	6	8	6	8	4	5	2	4	1	....	....	3	....	....	....	....	397
Encephalitis	70	15	1	21	22	10	2	2	57	7	1	2	1	4	5	2	2	1	1	....	2	....	....	....	....	....	....	....	....	85
Softening of the Brain	21	27	3	1	....	....	....	....	1	....	....	....	1	3	2	3	4	2	5	2	10	6	4	2	3	....	....	....	....	48
Apoplexy	83	133	5	9	2	1	....	....	12	....	2	1	2	1	12	25	20	25	19	24	28	16	11	9	5	2	....	1	....	216
Insanity	8	16	....	....	....	....	....	....	....	....	....	....	2	4	3	7	2	2	1	3	....	....	....	....	....	....	....	....	....	24
Epilepsy	18	21	1	....	....	....	1	....	1	2	4	3	5	4	5	4	2	3	2	....	2	....	....	....	2	....	....	....	....	39
Convulsions	534	16	7	409	87	26	8	7	537	13	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	550
Paralysis	38	41	3	....	2	2	1	....	5	....	....	3	2	4	3	8	9	6	4	3	8	5	8	6	2	3	....	....	....	79
Paraplegia	1	1	1	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	1	....	....	....	....	....	....	....	....	....	2
Hemiplegia	4	13	....	....	....	....	....	....	....	....	....	....	1	1	....	....	1	1	2	1	2	5	2	1	....	....	....	....	....	17
Progress'e Locomotor Ataxia	2	6	....	....	1	....	....	....	1	....	1	....	1	1	2	....	....	....	....	1	....	1	....	....	....	....	....	....	....	8
Chorea	2	1	....	....	....	....	....	....	....	....	1	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3
Tetanus	6	2	....	....	....	....	1	....	1	1	1	1	....	2	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	8
" (Idiopathic)	1	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Trismus Nascentium	29	....	....	29	....	....	....	....	29	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	29
Sun-stroke	5	19	....	....	1	....	....	....	1	1	....	....	2	4	6	4	2	2	2	....	....	....	....	....	....	....	....	....	....	24
Congestion of the Brain	89	27	1	31	15	7	2	2	57	10	3	....	3	5	1	6	1	5	5	7	4	4	3	1	1	....	....	....	....	116
Fright	3	....	....	1	....	1	1	....	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3
Total Nervous Diseases	1264	385	35	633	220	88	33	28	1002	58	26	20	28	40	48	65	51	53	46	44	60	38	28	19	16	6	....	1	....	1649
ORDER 2. (*Circulatory Diseases.*)																														
Pericarditis	21	24	2	....	1	....	1	....	2	....	6	2	2	2	5	4	5	4	5	5	3	....	....	....	....	....	....	....	....	45
Aneurism of the Heart	....	2	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	2
" " Aorta	15	32	3	....	....	....	....	....	....	....	1	2	1	1	8	9	3	11	7	1	3	....	....	....	....	....	....	....	....	47
Thrombosis	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	1
Epistaxis	1	2	....	....	....	....	....	....	....	....	....	....	1	1	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	3
Hypertrophy of the Heart	27	41	3	....	....	....	....	....	....	2	1	4	3	3	10	8	1	16	8	2	2	4	3	1	....	....	....	....	....	68
Valvular Disease "	58	59	4	2	1	....	1	2	6	8	2	4	8	10	4	6	8	17	13	7	10	10	3	1	....	....	....	....	....	117
Fatty Degeneration "	7	12	1	....	....	....	....	....	....	....	....	....	....	....	1	2	2	1	3	1	1	4	3	....	....	1	....	....	....	19
Disease of the Heart	36	65	3	2	2	....	....	....	4	3	4	2	8	9	10	14	9	8	6	2	7	5	3	5	....	2	....	....	....	101
Angina Pectoris	3	3	....	1	....	....	1	....	2	....	....	....	....	....	1	....	....	1	....	1	....	....	....	1	....	....	....	....	....	6
Phlebitis	3	1	....	....	....	....	....	....	....	....	....	1	....	....	....	1	....	....	....	2	....	....	....	....	....	....	....	....	....	4
Total Circulatory Diseases	172	241	16	5	4	....	3	2	14	13	14	15	23	27	39	44	28	58	42	22	26	23	14	8	....	3	....	....	....	413

CAUSES OF DEATH.	FEMALES.																															
	NATIVITY.																															
	United States.	Foreign.	Colored.	Under 1 year.	1–	2–	3–	4–	Total under 5 years.	5–	10–	15–	20–	25–	30–	35–	40–	45–	50–	55–	60–	65–	70–	75–	80–	85–	90–	95–	100 and upward.	TOTAL FEMALES.	TOTAL BOTH SEXES.	Percentage of each cause on Total.
Class III.																																
LOCAL DISEASES.																																
ORDER 1. (*Nervous Diseases.*)																																
Meningitis	286	42	4	111	66	43	20	11	251	18	7	7	4	4	4	6	7	3	3	1	4	3	3	1	1	1	....	....	....	328	725	2.88
Encephalitis	56	13	1	23	15	5	2	4	49	4	....	2	....	2	3	2	1	1	....	1	2	2	....	....	....	....	....	....	....	69	154	.61
Softening of the Brain	14	25	2	....	2	....	....	....	2	....	....	1	1	3	2	6	5	4	2	1	2	4	4	2	....	....	....	....	....	39	87	.35
Apoplexy	60	122	7	4	1	....	....	1	6	1	....	2	1	10	10	10	7	22	19	14	18	23	16	13	5	4	....	....	1	182	398	1.58
Insanity	4	22	1	....	....	....	....	....	....	....	....	....	3	3	1	2	6	4	1	1	2	2	1	....	....	....	....	....	....	26	50	.19
Epilepsy	18	10	2	....	....	1	....	....	1	1	2	3	3	4	1	5	3	....	3	....	1	1	....	....	....	....	....	....	....	38	67	.27
Convulsions	445	5	11	337	83	17	5	2	444	5	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	450	1000	3.97
Paralysis	28	37	2	....	1	1	....	2	4	1	....	....	1	2	....	....	4	3	4	2	4	12	13	8	3	4	....	....	....	65	144	.57
Paraplegia	2	5	....	....	....	....	....	....	....	....	....	....	....	1	1	....	1	....	1	1	....	....	....	1	1	....	....	....	....	7	9	.04
Hemiplegia	5	7	1	....	....	....	....	....	....	....	....	....	1	....	....	1	1	....	....	....	....	3	2	1	2	1	....	....	....	12	29	.12
Progress'e Locomotor Ataxia	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	8	.03
Chorea	3	1	....	....	....	....	....	....	....	....	3	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4	7	.03
Tetanus	......	2	....	....	....	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	2	10	.04
" (Idiopathic)	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	.004
Trismus Nascentium	17	....	....	17	....	....	....	....	17	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	17	46	.18
Sun-stroke	1	1	....	....	....	....	....	....	....	1	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	26	.10
Congestion of the Brain	71	21	....	26	18	5	3	2	54	6	3	1	1	1	4	4	2	5	3	2	2	1	....	3	....	....	....	....	....	92	208	.83
Otitis	2	1	....	2	....	....	....	....	2	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	3	3	.01
Fright	1	....	....	1	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	4	.02
Total Nervous Diseases	1013	314	31	521	186	72	30	22	831	37	16	16	16	30	27	38	37	42	37	23	35	51	39	29	12	10	....	....	1	1327	2976	11.82
ORDER 2. (*Circulatory Diseases.*)																																
Pericarditis	16	28	....	....	1	....	....	....	1	2	4	3	8	6	2	4	4	3	1	2	....	2	1	1	....	....	....	....	....	44	89	.35
Aneurism of the Heart	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	.01
" " Aorta	4	11	....	....	....	....	....	....	....	1	....	....	....	....	2	1	1	1	3	2	....	2	1	....	....	....	1	....	....	15	62	.25
Thrombosis	......	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	1	2	.01
Epistaxis	......	1	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	4	.02
Hypertrophy of the Heart	22	46	1	....	1	....	....	1	2	1	4	....	4	8	3	8	5	12	4	3	6	4	2	1	....	....	1	....	....	68	136	.54
Valvular Disease "	53	40	7	1	....	....	....	....	1	4	9	3	6	13	2	8	3	6	4	7	6	5	7	7	1	....	....	1	....	93	210	.83
Ossification "	3	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	2	1	....	....	....	....	....	4	4	.02
Fatty Degeneration "	2	8	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3	2	2	1	2	....	....	....	....	....	....	....	10	29	.12
Disease of the Heart	51	50	4	3	....	....	....	2	5	4	13	2	9	7	3	8	8	8	4	4	9	6	5	3	....	2	1	....	....	101	202	.80
Angina Pectoris	3	5	....	....	....	....	....	....	....	....	....	1	1	....	....	2	1	....	1	....	....	1	....	1	....	....	....	....	....	8	14	.05
Phlebitis	2	4	....	....	....	....	....	....	....	....	1	....	1	....	1	1	1	1	....	....	....	....	....	....	....	....	....	....	....	6	10	.04
Total Circulatory Diseases	156	195	12	4	2	....	....	3	9	12	31	9	29	34	14	32	24	34	19	20	23	22	18	14	1	2	3	1	....	351	764	3.04

DEATHS IN NEW YORK—Continued.

MALES.

CAUSES OF DEATH.	NATIVITY.		Colored.	Under 1 year.	1-	2-	3-	4-	Total under 5 years.	5-	10-	15-	20-	25-	30-	35-	40-	45-	50-	55-	60-	65-	70-	75-	80-	85-	90-	95-	100 and upward.	TOTAL MALES.
	United States.	Foreign.																												
Class III.—Continued.																														
ORDER 3. (*Respiratory Diseases.*)																														
Laryngitis	36	4	....	11	7	8	7	....	33	2	....	....	....	1	2	....	1	1	....	....	....	....	....	....	....	....	....	....	....	40
Bronchitis	376	89	9	231	71	38	13	5	358	5	2	....	1	5	3	11	3	11	8	9	11	12	8	10	4	3	1	....	....	465
Pneumonia	753	391	22	318	168	82	46	18	632	54	10	20	28	37	44	40	43	42	53	52	34	21	17	10	5	2	....	....	....	1144
Pleuritis	12	23	....	1	3	2	1	....	7	....	....	1	1	....	4	....	3	5	2	3	1	5	2	....	1	....	....	....	....	35
" Hydrothorax	9	15	....	1	1	1	1	1	5	1	1	1	3	2	....	1	1	....	2	3	3	....	1	....	....	....	....	....	....	24
Gangrene of the Lungs	4	13	1	....	....	....	....	....	....	....	....	....	1	1	3	1	2	3	3	....	1	1	1	....	....	....	....	....	....	17
Congestion "	74	33	1	35	9	4	2	3	53	5	3	....	4	1	5	3	2	7	3	4	4	4	4	5	....	....	....	....	....	107
Hæmorrhage "	13	37	1	....	....	....	....	....	....	....	....	4	6	5	4	4	6	2	8	3	4	2	1	1	....	....	....	....	....	50
Emphysema (Asthma)	5	13	2	....	....	....	....	....	....	....	....	1	....	....	1	....	1	2	3	1	3	2	2	1	....	1	....	....	....	18
Total Respiratory Diseases.	1282	618	36	597	259	135	70	27	1088	67	16	27	44	52	66	60	62	73	82	75	61	47	36	27	10	6	1	....	....	1900
ORDER 4. (*Digestive Diseases.*)																														
Gastritis	36	22	1	13	4	5	....	2	24	3	2	1	....	1	7	3	5	2	....	3	1	2	1	1	2	....	....	....	....	58
Enteritis	92	32	2	53	19	3	1	2	78	4	3	3	3	4	1	2	5	7	4	5	1	2	....	....	2	....	....	....	....	124
Gastro-enteritis	42	6	....	27	6	2	2	....	37	4	1	....	....	....	....	1	1	....	2	2	....	....	....	....	....	....	....	....	....	48
Peritonitis	42	41	....	2	2	1	....	....	5	9	3	7	7	6	14	10	7	4	....	2	2	3	2	1	1	....	....	....	....	83
Ascites	12	15	2	1	....	2	1	....	4	4	2	....	....	....	1	2	1	3	4	....	1	1	2	1	1	....	....	....	....	27
Ulceration of Intestines	4	5	1	....	1	1	....	....	2	....	....	1	....	1	....	1	1	1	....	1	....	1	....	....	....	....	....	....	....	9
Hernia (strangulated)	7	16	2	2	....	....	....	....	2	....	....	2	1	2	....	2	1	5	2	2	2	....	....	1	1	....	....	....	....	23
Hæmatemesis	4	6	1	2	....	....	....	....	2	....	....	....	....	....	1	1	1	1	2	2	....	....	....	....	....	....	....	....	....	10
Œsophagus (stricture)	1	2	....	1	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	1	1	....	....	....	....	....	....	....	....	3
Leucocythemia	1	1	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	1	....	....	....	....	....	....	....	....	....	2
Fistula in ano	1	2	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	1	1	....	....	....	....	....	....	....	....	....	....	3
Stricture of Intestines	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	1
Intussusception of Intestines	6	1	....	4	....	1	....	....	5	....	....	....	....	....	1	....	....	....	....	....	1	....	....	....	....	....	....	....	....	7
Ulcer of the Stomach	5	10	....	3	....	....	1	....	4	....	....	....	1	....	2	2	1	1	....	....	....	2	2	....	....	....	....	....	....	15
Colic	6	2	....	5	....	....	....	....	5	....	....	....	....	....	....	....	3	....	....	....	....	....	....	....	....	....	....	....	....	8
Fatty degeneration of Liver	4	7	....	....	1	....	....	....	1	....	....	1	....	1	2	1	1	2	1	....	....	....	....	1	....	....	....	....	....	11
Cirrhosis of the Liver	9	48	1	1	....	....	....	....	1	....	....	....	....	7	3	4	7	8	7	6	4	7	2	1	....	....	....	....	....	57
Hepatitis	19	27	1	3	2	1	....	....	6	1	1	2	1	3	5	4	4	6	2	2	5	1	1	....	2	....	....	....	....	46
Jaundice	11	5	....	8	1	....	....	....	9	....	1	....	....	....	....	1	....	1	....	1	1	1	1	....	....	....	....	....	....	16
Lead Poisoning	1	1	....	....	....	....	....	....	....	....	....	....	....	1	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	2
Total Digestive Diseases	303	250	11	125	36	16	5	4	186	25	13	17	13	26	38	35	39	42	26	28	19	20	11	6	9	....	....	....	....	553

CAUSES OF DEATH.	FEMALES.																															
	NATIVITY.																															
	United States.	Foreign.	Colored.	Under 1 year.	1-	2-	3-	4-	Total under 5 years.	5-	10-	15-	20-	25-	30-	35-	40-	45-	50-	55-	60-	65-	70-	75-	80-	85-	90-	95-	100 and upward.	TOTAL FEMALES.	TOTAL BOTH SEXES.	Percentage of each cause on Total.
Class III.—Continued.																																
ORDER 3. (*Respiratory Diseases.*)																																
Laryngitis	27	4	....	6	6	7	4	1	24	2	....	....	....	1	2	....	....	....	1	....	....	1	....	....	....	....	....	....	....	31	71	.28
Bronchitis	289	123	6	155	76	29	14	5	279	9	2	1	....	4	3	3	6	6	7	3	13	19	22	16	9	9	1	....	....	412	877	3.48
Pneumonia	699	257	16	302	152	60	34	33	581	35	4	12	18	30	30	29	27	21	20	21	35	34	21	20	13	4	1	....	....	956	2100	8.34
Pleuritis	12	20	2	5	1	....	1	....	7	1	2	....	4	2	2	3	1	4	1	....	2	1	2	....	....	....	....	....	....	32	67	.27
" Hydrothorax	8	11	....	....	....	....	....	1	1	....	1	....	1	....	2	1	2	1	2	3	1	1	3	....	....	....	....	....	....	19	43	.17
" Empyema	....	1	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	.004
Gangrene of the Lungs	1	2	....	....	....	....	1	....	1	....	....	....	....	....	1	....	....	1	....	....	....	....	....	....	....	....	....	....	....	3	20	.08
Congestion "	68	29	3	29	11	4	1	4	49	3	1	1	....	5	3	3	2	3	4	4	4	5	4	2	4	....	....	....	....	97	204	.81
Hæmorrhage "	9	12	....	1	....	....	....	1	2	1	....	....	2	....	5	3	....	2	2	2	1	....	....	....	....	1	....	....	....	21	71	.28
Emphysema (Asthma)	4	18	1	....	1	....	....	....	1	....	....	....	....	....	1	2	6	2	1	1	3	2	1	1	1	....	....	....	....	22	40	.16
Total Respiratory Diseases.	1117	477	28	498	247	100	55	45	945	51	10	14	26	42	49	44	44	40	38	34	59	63	53	39	27	14	2	....	...	1594	3494	13.87
ORDER 4. (*Digestive Diseases.*)																																
Gastritis	43	42	1	20	5	3	....	....	28	4	....	1	4	3	5	5	11	7	3	4	2	3	3	1	....	1	....	....	....	85	143	.57
Enteritis	75	34	5	38	15	3	4	3	63	2	1	1	4	3	4	6	1	5	1	5	3	8	1	1	....	....	....	....	...	109	233	.93
Gastro-enteritis	29	7	....	18	2	3	2	1	26	....	....	....	....	2	2	2	....	1	....	1	....	1	....	....	1	....	....	....	....	36	84	.33
Peritonitis	59	82	2	5	2	3	3	2	15	6	....	7	16	16	14	17	11	12	8	5	3	2	4	2	2	1	....	....	....	141	224	.89
Ascites	6	23	....	....	....	....	....	....	....	1	...	1	1	1	1	2	1	8	5	2	3	2	1	....	....	....	....	....	....	29	56	.22
Ulceration of Intestines	2	1	....	2	....	....	....	....	2	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3	12	.05
Hernia (strangulated)	3	14	....	1	....	....	....	....	1	....	....	....	1	....	1	1	3	1	5	1	1	....	1	....	1	....	....	....	....	17	40	.16
Hæmatemesis	4	2	....	1	1	....	....	....	2	....	...	....	....	....	2	....	....	....	....	1	....	1	....	....	....	....	....	....	....	6	16	.06
Œsophagus (stricture)	1	....	....	....	....	....	....	1	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	4	.02
Leucocythemia	....	1	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	3	.01
Fistula in ano	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	1	4	.02
Stricture of Intestines	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	.004
Intussusception of Intestines	8	2	....	4	1	....	....	....	5	1	....	....	....	....	....	....	....	2	1	....	1	....	....	....	....	....	....	....	....	10	17	.07
Ulcer of the Stomach	2	8	1	....	....	....	....	....	....	....	....	...	....	3	1	....	....	2	1	1	2	....	....	....	....	....	....	...	....	10	25	.10
Colic	6	3	1	5	....	....	1	....	6	....	....	....	....	....	....	....	2	....	1	....	....	....	....	....	....	....	....	....	....	9	17	.07
Fatty degeneration of Liver	3	8	....	....	....	....	....	....	...	....	....	....	....	1	2	2	1	2	1	....	....	1	1	....	....	....	....	....	....	11	22	.09
Cirrhosis of the Liver	8	35	....	....	....	....	....	....	....	....	....	....	....	2	1	5	11	7	5	....	7	2	2	....	1	....	....	....	....	43	100	.40
Hepatitis	14	24	....	1	....	....	....	1	2	....	....	2	....	1	3	2	4	7	2	2	3	6	2	2	....	....	....	....	....	38	84	.33
Jaundice	17	3	....	12	1	1	2	....	16	....	....	1	....	....	....	....	....	....	1	....	2	....	....	....	....	....	....	....	....	20	36	.14
Lead Poisoning	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	...	....	....	....	....	....	....	....	....	....	....	2	.01
Total Digestive Diseases...	281	289	10	107	27	13	12	8	167	14	1	14	26	32	37	42	45	54	34	22	28	26	15	6	5	2	....	....	....	570	1123	4,47

DEATHS IN NEW YORK—Continued.

CAUSES OF DEATH.	MALES.																													
	NATIVITY.		Colored.	Under 1 year.	1-	2-	3-	4-	Total under 5 years.	5-	10-	15-	20-	25-	30-	35-	40-	45-	50-	55-	60-	65-	70-	75-	80-	85-	90-	95-	100 and upward.	TOTAL MALES.
	United States.	Foreign.																												
Class III.—Continued.																														
ORDER 5. (*Urinary Diseases.*)																														
Nephritis	28	17	2	1	5	3	2	3	14	6	....	1	2	1	4	4	2	1	2	1	5	1	1	....	....	....	....	....	....	45
Nephria (Bright's Disease)	113	217	11	2	3	8	....	6	19	16	5	8	17	14	32	31	40	45	28	17	22	17	9	7	2	1	....	....	....	330
Uræmia	19	18	1	3	....	....	....	....	3	5	....	1	2	5	3	5	....	4	1	2	1	1	2	....	2	....	....	....	....	37
Diabetes	7	6	....	....	....	....	....	....	....	....	2	....	....	2	1	2	1	1	....	1	1	....	1	....	....	1	....	....	....	13
Calculus	1	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	1	....	....	....	....	....	....	....	2
Cystitis	7	9	....	....	....	....	....	....	....	....	....	....	....	....	1	2	....	2	2	2	1	2	4	....	....	....	....	....	....	16
Suppression of Urine	2	....	....	1	....	....	....	....	1	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	2
Stricture of Urethra, etc.	4	3	....	1	....	....	....	....	1	....	....	....	....	1	1	1	1	1	....	....	....	1	....	....	....	....	....	....	....	7
Granular Kidney*	....	3	....	....	....	....	....	....	....	....	....	....	1	1	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	3
Addison's Disease	....	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	2	....	....	....	....	3
Orchitis	1	1	....	1	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	2
Total Urinary Diseases	182	278	14	9	8	11	2	9	39	27	7	10	22	24	42	45	45	55	34	23	30	23	17	9	6	2	....	....	....	460
ORDER 7. (*Locomotory Diseases.*)																														
Arthritis	2	2	1	....	....	....	....	....	....	1	....	....	....	....	1	....	....	....	1	1	....	....	....	....	....	....	....	....	....	4
Osteo-myelitis	18	4	....	....	....	....	1	2	3	8	3	1	1	2	....	1	....	1	1	....	1	....	....	....	....	....	....	....	....	22
Necrosis	1	4	....	....	....	....	....	....	....	....	....	1	....	1	1	....	....	1	....	....	1	....	....	....	....	....	....	....	....	5
Spinal Disease	7	5	1	3	....	....	1	....	4	2	1	1	....	2	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	12
Caries	4	1	....	....	....	....	....	....	....	2	1	1	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	5
Total Locomotory Diseases.	32	16	2	3	....	....	2	2	7	13	5	4	1	5	2	1	....	4	2	1	2	1	....	....	....	....	....	....	....	48

FEMALES.

CAUSES OF DEATH.	NATIVITY.		Colored.	Under 1 year.	1-	2-	3-	4-	Total under 5 years.	5-	10-	15-	20-	25-	30-	35-	40-	45-	50-	55-	60-	65-	70-	75-	80-	85-	90-	95-	100 and upward.	TOTAL FEMALES.	TOTAL BOTH SEXES.	Percentage of each cause on Total.
	United States.	Foreign.																														
Class III.—Continued.																																
ORDER 5. (*Urinary Diseases.*)																																
Nephritis	19	16	1	1	1	3	....	....	5	5	1	1	3	3	3	1	3	1	2	....	1	4	2	....	....	....	....	....	....	35	80	.32
Nephria (Bright's Disease)	91	136	13	2	2	2	1	4	11	9	10	9	22	13	17	20	21	21	23	14	8	7	14	5	2	....	1	....	....	227	557	2.22
Uræmia	17	13	4	....	....	....	1	....	1	1	....	2	4	6	4	4	....	2	2	....	1	1	....	....	2	....	....	....	....	30	67	.27
Diabetes	5	4	....	....	....	....	....	....	....	....	....	....	....	....	2	....	1	....	3	....	2	....	....	1	....	....	....	....	....	9	22	.09
Calculus	1	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	3	.01
Cystitis	1	5	....	....	....	....	1	....	1	....	....	....	....	2	....	....	1	1	....	....	....	....	....	1	....	....	....	....	....	6	22	.09
Suppression of Urine	....	1	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	3	.01
Stricture of Urethra, etc.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	7	.03
Granular Kidney*	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	....	....	....	....	....	....	....	2	5	.02
Addison's Disease	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3	.01
Orchitis	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	.01
Total Urinary Diseases	134	177	18	3	3	5	3	4	18	15	11	12	31	24	26	25	26	25	30	14	13	13	16	7	4	....	1	....	....	311	771	3.06
ORDER 6. (*Generative Diseases.*)																																
Ovarian Tumor	3	10	....	....	....	....	....	....	....	....	....	....	....	....	1	1	2	3	4	....	1	1	....	....	....	....	....	....	....	13	13	.05
" Dropsy	3	8	....	....	....	....	....	....	....	....	....	....	1	....	2	....	....	2	1	2	....	2	1	....	....	....	....	....	....	11	11	.04
Metritis	12	24	....	....	....	....	....	....	....	....	....	2	7	7	9	5	3	2	....	....	....	....	....	....	1	....	....	....	....	36	36	.14
Metro-peritonitis	17	23	1	....	....	....	....	....	....	....	....	5	5	12	7	7	4	....	....	....	....	....	....	....	....	....	....	....	....	40	40	.16
Uterine Tumor	....	5	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	1	1	....	....	1	....	....	....	....	....	....	....	5	5	.02
Total Generative Diseases	35	70	1	....	....	....	....	....	....	....	....	7	13	19	19	14	10	8	6	2	1	4	1	....	1	....	....	....	....	105	105	.42
ORDER 7. (*Locomotory Diseases.*)																																
Arthritis	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	1	5	.02
Osteo-myelitis	7	3	....	1	....	....	....	....	1	3	4	....	....	1	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	10	32	.12
Necrosis	2	1	1	1	....	....	....	....	1	....	....	....	....	1	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	3	8	.03
Spinal Disease	8	5	....	5	....	....	....	1	6	1	....	1	1	....	....	....	2	1	1	....	....	....	....	....	....	....	....	....	....	13	25	.10
Caries	4	1	....	....	....	....	....	....	....	2	....	....	1	....	1	1	....	....	....	....	....	....	....	....	....	....	....	....	....	5	10	.04
Total Locomotory Diseases	21	11	1	7	....	....	....	1	8	6	4	1	2	2	1	3	2	1	1	....	....	1	....	....	....	....	....	....	....	32	80	.32

* Bright's disease (nephria), but registered separately in these five instances.

DEATHS IN NEW YORK—Continuod.

CAUSES OF DEATH.	MALES.																												
	NATIVITY.																												
	United States.	Foreign.	Colored.	Under 1 year.	1-	2-	3-	4-	Total under 5 years.	5-	10-	15-	20-	25-	30-	35-	40-	45-	50-	55-	60-	65-	70-	75-	80-	85-	90-	95-	100 and upward.	TOTAL MALES.
***Class III.**—Continued.*																														
ORDER 8. (*Integumentary Diseases.*)																														
Abscess (Phlegmon)........	25	8	2	9	1	1	1	2	14	1	....	....	2	2	3	1	3	5	....	1	....	1	....	....	....	....	....	....	....	33
Mortification of Penis........	1	....	....	1	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Tumor........	2	2	....	....	1	....	....	....	1	....	....	....	....	1	....	....	....	1	....	....	1	....	....	....	....	....	....	....	....	4
Psoriasis........	1	....	....	1	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Erythema........	1	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Carbuncle........	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	1
Total Integumentary Diseases..	31	10	2	11	2	1	1	2	17	2	....	....	2	3	3	1	3	6	....	1	1	1	....	1	....	....	....	....	....	41
Total Local Class.....	**3266**	**1798**	**116**	**1383**	**529**	**251**	**116**	**74**	**2353**	**205**	**81**	**93**	**133**	**177**	**238**	**251**	**228**	**291**	**232**	**194**	**199**	**153**	**106**	**70**	**41**	**17**	**1**	**1**	......	**5064**
Class IV.																														
DEVELOPMENTAL DISEASES.																														
ORDER 1. (*Children.*)																														
Premature Birth........	227	1	3	228	....	....	....	....	228	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	228
Preternatural Birth........	8	....	....	8	....	....	....	....	8	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	8
Cyanosis........	45	....	....	43	....	....	....	1	44	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	45
Sclerema........	1	....	....	1	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Atelectasis Pulmonum........	50	....	1	50	....	....	....	....	50	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	50
Malformations (various)......	42	....	2	42	....	....	....	....	42	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	42
Total Developmental Diseases of Children..	373	1	6	372	....	....	....	1	373	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	374

FEMALES.

CAUSES OF DEATH.	NATIVITY.		Colored.	Under 1 year.	1-	2-	3-	4-	Total under 5 years.	5-	10-	15-	20-	25-	30-	35-	40-	45-	50-	55-	60-	65-	70-	75-	80-	85-	90-	95-	100 and upward.	TOTAL FEMALES.	TOTAL BOTH SEXES.	Percentage of each cause on Total.
	United States.	Foreign.																														
Class III.—Continued.																																
ORDER 8. (*Integumentary Diseases.*)																																
Abscess (Phlegmon)	20	10	1	6	....	1	2	...	9	3	3	....	5	3	1	1	2	....	....	....	1	....	1	....	....	1	....	....	....	30	63	.25
Mortification of Penis	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	.004
Tumor	2	2	....	1	1	....	....	....	2	....	....	....	....	....	....	....	....	....	1	....	....	....	1	....	....	....	....	....	....	4	8	.03
Psoriasis	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	.004
Exostosis	1	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	.004
Erythema	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	.004
Carbuncle	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	.004
Total Integumentary Diseases	23	12	1	7	1	1	2	...	11	3	4	....	5	3	1	1	2	....	1	....	1	....	2	....	....	1	....	....	....	35	76	.30
Total Local Class	**2780**	**1545**	**102**	**1147**	**466**	**191**	**102**	**83**	**1989**	**138**	**77**	**73**	**148**	**186**	**174**	**199**	**190**	**204**	**166**	**115**	**160**	**180**	**144**	**95**	**50**	**29**	**6**	**1**	**1**	**4325**	**9389**	**37.31**
Class IV.																																
DEVELOPMENTAL DISEASES.																																
ORDER 1. (*Children.*)																																
Premature Birth	178	....	1	178	....	....	....	....	178	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	178	406	1.61
Preternatural Birth	5	....	..	5	....	....	....	....	5	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	5	13	.05
Cyanosis	38	1	1	38	1	....	....	....	39	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	39	84	.33
Sclerema	1	....	....	1	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	2	.01
Atelectasis Pulmonum	39	....	....	39	....	....	....	....	39	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	39	89	.35
Malformations (various)	31	....	....	31	....	....	....	....	31	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	31	73	.29
Total Developmental Diseases of Children	292	1	2	292	1	....	....	...	293	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	293	667	2.65

DEATHS IN NEW YORK—Continued.

CAUSES OF DEATH.	MALES.																													
	NATIVITY.																													
	United States.	Foreign.	Colored.	Under 1 year.	1-	2-	3-	4-	Total under 5 years.	5-	10-	15-	20-	25-	30-	35-	40-	45-	50-	55-	60-	65-	70-	75-	80-	85-	90-	95-	100 and upward.	TOTAL MALES.
***Class IV.**—Continued.*																														
ORDER 3. (*Age.*)																														
Old age	27	70	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	1	2	11	19	28	20	10	3	2	97
Senile Gangrene	2	4	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	3	1	....	1	....	....	....	6
Total Diseases of Age	29	74	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	1	3	14	20	28	21	10	3	2	103
ORDER 4. (*Nutrition.*)																														
Atrophy	24	1	....	21	1	1	....	....	23	....	....	1	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	25
Debility	107	23	2	94	3	....	2	....	99	....	....	1	1	3	2	....	1	1	1	1	6	5	2	5	....	1	....	1	....	130
Total Diseases of Nutrition.	131	24	2	115	4	1	2	....	122	....	...	2	1	3	2	....	1	2	1	1	6	5	2	5	...	1	....	1	....	155
Total Developmental Class	533	99	8	487	4	1	2	1	495	1	....	2	1	3	2	....	1	2	2	1	7	8	16	25	28	22	10	4	2	632

FEMALES.

CAUSES OF DEATH.	NATIVITY.		Colored.	Under 1 year.	1-	2-	3-	4-	Total under 5 years.	5-	10-	15-	20-	25-	30-	35-	40-	45-	50-	55-	60-	65-	70-	75-	80-	85-	90-	95-	100 and upward.	TOTAL FEMALES.	TOTAL BOTH SEXES.	Percentage of each cause on Total.
	United States.	Foreign.																														
Class IV.—Continued.																																
ORDER 2. (*Women.*)																																
Chlorosis	1	2	....	....	....	....	....	....	....	....	....	1	1	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3	3	.01
Childbirth	4	21	....	....	....	....	....	....	....	....	....	2	3	5	6	6	3	....	....	....	....	....	....	....	....	....	....	....	....	25	25	.10
Flooding	9	25	1	....	....	....	....	....	....	....	....	1	1	8	7	11	4	1	....	1	....	....	....	....	....	....	....	....	....	34	34	.13
Puerperal Metritis	7	42	1	....	....	....	....	....	....	....	....	3	7	12	13	10	2	1	1	....	....	....	....	....	....	....	....	....	....	49	49	.19
" Convulsions	24	24	1	....	....	....	....	....	....	....	....	9	15	8	10	5	1	....	....	....	....	....	....	....	....	....	....	....	....	48	48	.19
" Mania	2	3	....	....	....	....	....	....	....	....	....	....	2	1	....	....	1	1	....	....	....	....	....	....	....	....	....	....	....	5	5	.02
Miscarriage	2	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	2	2	.01
Phlegmasia Dolens	1	2	....	....	....	....	....	....	....	....	....	1	....	1	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3	3	.01
Total Developmental Diseases of Women	50	119	3	....	....	....	....	....	....	...	....	17	30	35	38	32	12	3	1	1	....	....	....	....	....	....	....	...	....	169	169	.67
ORDER 3. (*Age.*)																																
Old age	58	134	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	12	21	43	56	30	18	7	4	192	289	1.15
Senile Gangrene	1	6	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	1	2	....	2	....	....	....	7	13	.05
Total Diseases of Age	59	140	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	14	22	45	56	32	18	7	4	199	302	1.20
ORDER 4. (*Nutrition.*)																																
Atrophy	19	3	....	17	1	1	....	....	19	....	....	....	....	....	....	1	1	....	....	1	....	....	....	....	....	....	....	....	....	22	47	.19
Asthenia (Debility)	92	28	....	75	5	....	....	....	80	2	....	1	3	2	1	....	....	2	3	1	4	5	4	7	4	....	1	....	....	120	250	.99
Total Diseases of Nutrition	111	31	....	92	6	1	....	....	99	2	....	1	3	2	1	1	1	2	3	2	4	5	4	7	4	....	1	....	....	142	297	1.18
Total Developmental Class	**512**	**291**	**8**	**384**	**7**	**1**	....	....	**392**	**2**	....	**18**	**33**	**37**	**39**	**33**	**13**	**5**	**4**	**3**	**5**	**19**	**26**	**52**	**60**	**32**	**19**	**7**	**4**	**803**	**1435**	**5.70**

DEATHS IN NEW YORK—Continued.

CAUSES OF DEATH.	MALES.																													
	NATIVITY.		Colored.	Under 1 year.	1-	2-	3-	4-	Total under 5 years.	5-	10-	15-	20-	25-	30-	35-	40-	45-	50-	55-	60-	65-	70-	75-	80-	85-	90-	95-	100 and upward.	TOTAL MALES.
	United States,	Foreign.																												
Class V.																														
DEATHS BY VIOLENCE.																														
ORDER 1. (*Accidents and Negligence.*)																														
Fractures and Contusions....	40	86	....	3	....	3	....	1	7	9	5	6	6	15	13	11	18	16	10	3	4	1	1	1	....	....	....	....	....	126
Wounds....................	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	1
" *a* Incised............	2	3	....	....	....	....	....	....	....	....	....	2	....	1	....	1	1	....	....	....	....	....	....	....	....	....	....	....	....	5
" *b* Gunshot............	4	6	....	....	....	....	....	....	....	....	1	1	2	3	....	....	1	....	2	....	....	....	....	....	....	....	....	....	....	10
" *c* Penetrating.........	....	1	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
By Vehicles, etc., in Streets..	29	33	....	....	....	....	2	2	4	8	8	2	5	8	5	3	7	6	2	2	....	....	....	....	2	....	....	....	....	62
Falls.....................	51	115	....	1	3	2	2	1	9	14	7	5	8	17	22	15	20	18	13	4	4	3	3	1	1	1	1	....	....	166
Burns (Scalds)............	47	9	1	7	10	8	10	5	40	5	3	....	....	3	....	1	2	1	1	....	....	....	....	....	....	....	....	....	....	56
Poison....................	8	4	....	5	....	....	....	....	5	....	....	....	1	1	....	1	....	....	1	3	....	....	....	....	....	....	....	....	....	12
Suffocation (Asphyxia)......	24	6	1	20	1	....	....	....	21	....	1	....	....	2	1	1	....	3	....	....	....	....	....	1	....	....	....	....	....	30
Drowning..................	43	122	1	1	....	1	....	....	2	14	14	5	7	17	18	29	26	14	8	3	7	1	....	....	....	....	....	....	....	165
Total Deaths by Accidents and Negligence.......	249	385	3	37	14	14	14	9	88	50	39	21	30	67	59	62	76	58	37	15	15	5	4	3	3	1	1	....	....	634
ORDER 3. (*Homicide.*)																														
Wounds (various)...........	7	15	1	2	....	....	....	....	2	....	1	1	2	7	3	....	3	....	....	....	1	1	....	1	....	....	....	....	....	22
" Gunshot............	1	3	....	....	....	....	....	....	....	....	....	....	....	1	1	2	....	....	....	....	....	....	....	....	....	....	....	....	....	4
Total Deaths by Murder and Manslaughter....	8	18	1	2	....	....	....	....	2	....	1	1	2	8	4	2	3	....	....	....	1	1	....	1	....	....	....	....	....	26
ORDER 4. (*Suicide.*)																														
By Poison..................	7	14	....	....	....	....	....	....	....	....	....	....	2	1	4	2	....	6	5	....	....	1	....	....	....	....	....	....	....	21
" Drowning................	....	3	....	....	....	....	....	....	....	....	....	....	....	....	1	....	1	....	1	....	....	....	....	....	....	....	....	....	....	3
" Hanging.................	1	17	....	....	....	....	....	....	....	....	....	....	....	1	4	1	2	4	3	1	....	1	1	....	....	....	....	....	....	18
" Cut, Stab...............	3	5	....	....	....	....	....	....	....	....	....	....	....	....	2	....	....	1	2	....	2	1	....	....	....	....	....	....	....	8
" Gunshot.................	8	16	....	....	....	....	....	....	....	....	....	....	5	2	2	4	5	....	5	1	....	....	....	....	....	....	....	....	....	24
" Jumping from Height....	1	1	....	....	....	....	....	....	....	....	....	....	....	1	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	2
Total Deaths by Suicide....	20	56	....	....	....	....	....	....	....	....	....	....	7	5	13	7	9	11	16	2	2	3	1	....	....	....	....	....	....	76
Undefined (not specified)........	6	2	1	6	....	....	....	....	6	....	....	....	....	1	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	8
Total Deaths by Violence.	**283**	**461**	**5**	**45**	**14**	**14**	**14**	**9**	**96**	**50**	**40**	**22**	**39**	**81**	**76**	**71**	**88**	**70**	**53**	**17**	**18**	**9**	**5**	**4**	**3**	**1**	**1**	....	....	**744**

CAUSES OF DEATH.	FEMALES. Nativity.																														
	United States.	Foreign.	Colored.	Under 1 year.	1-	2-	3-	4-	Total under 5 years.	5-	10-	15-	20-	25-	30-	35-	40-	45-	50-	55-	60-	65-	70-	75-	80-	85-	90-	95-	100 and upward.	Total Females.	Total both Sexes.	Percentage of each cause on Total.
Class V.																																
DEATHS BY VIOLENCE.																																
ORDER 1. (*Accidents and Negligence.*)																																
Fractures and Contusions....	1	7	....	....	....	1	....	....	1	....	....	....	....	2	1	....	2	....	1	....	....	....	....	....	1	....	....	....	....	8	134	.53
Wounds..................	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	.004
" *a* Incised............	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	5	.02
" *b* Gunshot............	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	10	.04
" *c* Penetrating........	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	.004
By Vehicles, etc., in Streets..	5	3	....	....	....	3	1	....	4	1	....	....	....	....	....	....	....	....	....	....	1	2	....	....	....	....	....	....	....	8	70	.28
Falls....................	12	21	....	1	2	....	1	....	4	3	2	1	6	1	3	1	....	3	1	....	1	....	3	....	1	1	1	1	....	33	199	.79
Burns (Scalds)............	40	22	....	....	7	10	7	4	28	5	3	2	8	3	....	3	....	2	2	1	2	2	....	1	....	....	....	....	....	62	118	.47
Poison....................	6	5	....	....	....	....	1	....	1	....	1	....	4	1	....	2	....	1	....	....	1	....	....	....	....	....	....	....	....	11	23	.09
Overdose of Whiskey........	1	....	....	....	....	....	....	1	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	.004
Suffocation (Asphyxia).......	22	1	....	18	1	1	....	1	21	....	....	....	1	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	23	53	.21
Drowning..................	5	12	....	....	2	....	....	1	3	1	1	1	1	2	1	1	2	3	....	....	....	1	....	....	....	....	....	....	....	17	172	.68
Total Deaths by Accidents and Negligence.........	92	71	....	19	12	15	10	7	63	10	7	4	20	9	5	8	4	9	4	1	5	5	3	1	2	1	1	1	....	163	797	3.17
ORDER 3. (*Homicide.*)																																
Thrown from Height.........	......	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	1	1	.004
Wounds (various)...........	3	6	....	1	....	....	....	....	1	....	....	....	1	1	....	2	2	....	1	....	....	....	....	1	....	....	....	....	....	9	31	.12
" Gunshot............	......	1	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	1	5	.02
Total Deaths by Murder and Manslaughter.....	3	8	...	1	....	....	....	....	1	....	....	....	1	1	....	3	2	....	2	....	....	....	....	1	....	....	....	....	....	11	37	.15
ORDER 4. (*Suicide.*)																																
By Poison..................	3	10	....	....	....	....	....	....	....	....	....	....	1	2	5	1	2	1	....	1	....	....	....	....	....	....	....	....	....	13	24	.13
" Drowning...............	......	5	....	....	....	....	....	....	....	....	....	....	....	1	....	2	1	....	...	....	...	....	....	1	....	....	....	....	....	5	8	.03
" Hanging................	1	1	....	....	....	....	....	....	....	....	....	1	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	20	.08
" Cut, Stab...............	2	3	....	....	....	....	....	....	....	....	....	....	....	1	2	....	....	1	....	1	....	....	....	....	....	....	....	....	....	5	13	.05
" Gunshot................	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	24	.10
" Jumping from Height....	......	1	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	3	.01
Total Deaths by Suicide....	6	20	....	....	....	....	....	....	....	....	....	1	1	6	7	3	3	2	...	2	....	....	....	1	....	...	....	....	....	26	102	.40
Undefined (not specified)........	3	....	....	3	....	....	....	....	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3	11	.04
Total Deaths by Violence.	**104**	**99**	....	**23**	**12**	**15**	**10**	**7**	**67**	**10**	**7**	**5**	**22**	**16**	**12**	**14**	**9**	**11**	**6**	**3**	**5**	**5**	**3**	**3**	**2**	**1**	**1**	**1**	....	**203**	**947**	**3.76**

RECAPITULATION.—Total Deaths by Classes—Percentages.

CAUSES OF DEATH.		NATIVITY.		Colored.	Under 1 year.	1–	2–	3–	4–	Total under 5 years.	5–	10–	15–	20–	25–	30–	35–	40–	45–	50–	55–	60–	65–	70–	75–	80–	85–	90–	95–	100 and upward.	Total by sexes.	Percentage of each class on total.
		United States.	Foreign.																													
CLASSES—																																
Zymotic................	M.	3,210	822	42	1,553	718	344	219	142	2,976	202	53	52	80	98	94	93	87	66	67	44	45	33	13	16	7	3	2	1	..	4,032	16.02
	F.	2,969	675	40	1,390	682	288	205	159	2,724	217	39	56	98	79	79	70	63	35	45	38	30	27	18	14	6	2	2	1	1	3,644	14.48
Total of both sexes.......		6,179	1,497	82	2,943	1,400	632	424	301	5,700	419	92	108	178	177	173	163	150	101	112	82	75	60	31	30	13	5	4	2	1	7,676	30.50
Constitutional..........	M.	1,499	1,398	79	534	239	98	34	26	931	66	30	80	202	243	246	217	202	166	141	106	101	80	48	24	9	5	..	..	..	2,897	11.51
	F.	1,401	1,422	92	459	235	92	31	19	836	50	27	97	248	260	204	251	203	158	120	90	88	80	56	37	10	5	2	1	..	2,823	11.22
Total of both sexes.......		2,900	2,820	171	993	474	190	65	45	1,767	116	57	177	450	503	450	468	405	324	261	196	189	160	104	61	19	10	2	1	..	5,720	22.73
Local..................	M.	3,266	1,798	116	1,383	529	251	116	74	2,353	205	81	93	133	177	238	251	228	291	232	194	199	153	106	70	41	17	1	1	..	5,064	20.12
	F.	2,780	1,545	102	1.147	466	191	102	83	1,989	138	77	73	148	186	174	199	190	204	166	115	160	180	144	95	50	29	6	1	1	4,325	17.19
Total of both sexes.......		6,046	3,343	218	2,530	995	442	218	157	4,342	343	158	166	281	363	412	450	418	495	398	309	359	333	250	165	91	46	7	2	1	9,389	37.31
Developmental..........	M.	533	99	8	487	4	1	2	1	495	1	..	2	1	3	2	..	1	2	2	1	7	8	16	25	28	22	10	4	2	632	2.51
	F.	512	291	8	384	7	1		..	392	2	..	18	33	37	39	33	13	5	4	3	5	19	26	52	60	32	19	7	4	803	3.19
Total of both sexes... ...		1,045	390	16	871	11	2	2	1	887	3	..	20	34	40	41	33	14	7	6	4	12	27	42	77	88	54	29	11	6	1,435	5.70
Violence................	M.	283	461	5	45	14	14	14	9	96	50	40	22	39	81	76	71	88	70	53	17	18	9	5	4	3	1	1	..	..	744	2.96
	F.	104	99		23	12	15	10	7	67	10	7	5	22	16	12	14	9	11	6	3	5	05	3	3	2	1	1	1	..	203	.81
Total of both sexes.......		387	560	5	68	26	29	24	16	163	60	47	27	61	97	88	85	97	81	59	20	23	14	8	7	5	2	2	1	..	947	3.77
Total (by sexes)........	M.	8,791	4,578	250	40,02	1,504	708	385	252	6,851	524	204	249	455	602	656	632	606	595	495	362	370	283	188	139	88	48	14	6	2	13,369	53.12
	F.	7,766	4,032	242	34,03	1,402	587	348	268	6,008	417	150	249	549	578	508	567	478	413	341	249	288	311	247	201	128	69	30	11	6	11,798	46.88
Total of both sexes..........		16,557	8,610	492	74,05	2,906	1295	733	520	12,859	941	354	498	1004	1180	1164	1199	1084	1008	836	611	658	594	435	340	216	117	44	17	8	25,167	....
Percentage on total mortality given by deaths of each sex in each period of life..............	M.	34.93	18.19	.99	15.90	5.98	2.81	1.53	1.00	27.22	2.08	.81	.99	1.81	2.39	2.60	2.51	2.41	2.36	1.97	1.44	1.47	1.12	.75	.55	.35	.19	.05	.03	.01	53.12	....
	F.	30.86	16.02	.96	13.52	5.57	2.33	1.38	1.07	23.87	1.66	.59	.99	2.18	2.30	2.02	2.25	1.90	1.64	1.35	.99	1.14	1.24	.98	.80	.51	.27	.12	.04	.02	46.88	...
Percentage on total mortality given by deaths of both sexes in each period of life.		65.79	34.21	1.95	29.42	11.55	5.14	2.91	2.07	51.09	3.74	1.40	1.98	3.99	4.69	4.62	4.76	4.31	4.00	3.32	2.43	2.61	2.36	1.73	1.35	.86	.46	.17	.07	.03	100.00	....

CONDENSED SUMMARY OF THE MORTALITY RECORDS IN THE FOUR SUCCESSIVE YEARS 1866, 1867, 1868, AND 1869. BY CLASSES OF CAUSES; AT THE DIFFERENT AGES, WITH PERCENTAGES OF THE SAME.

CAUSES OF DEATH.		NATIVITY.		Under 1 year.	1-	2-	3-	4-	Total under 5 years.	5-	10-	15-	20-	25-	30-	35-	40-	45-	50-	55-	60-	65-	70-	75-	80-	85-	90-	95-	100 and upward.	Total of both Sexes.	Percentage of each Class on Total.
		U. S.	Foreign																												
CLASSES.																															
Zymotic	1866	....	....	2,600	1,280	524	341	257	5,002	501	162	216	405	438	383	352	298	241	224	193	162	133	61	47	31	6	1	2	1	8,859	33.04
	1867	....	....	2,556	1,281	505	294	181	4,917	306	71	85	152	163	170	159	100	104	80	70	69	52	40	22	10	10	3	....	....	6,583	28.41
	1868	....	....	3,394	1,336	478	310	188	5,706	396	72	103	146	178	154	137	80	115	90	48	76	69	35	28	14	6	2	1	....	7,456	29.96
	1869	....	....	2,943	1,400	632	424	301	5,700	419	92	108	178	177	173	163	150	101	112	82	75	60	31	30	13	5	4	2	1	7,676	30.50
Constitutional	1866	....	....	1,352	518	184	82	45	2,181	131	83	219	486	479	458	450	359	303	252	204	170	152	87	54	26	8	1	1	....	6,104	22.76
	1867	....	....	1,042	483	165	75	50	1,815	108	71	188	444	480	412	470	367	311	237	166	157	141	69	49	21	7	...	...	....	5,513	23.80
	1868	....	....	997	513	142	66	39	1,757	109	60	188	483	521	468	444	355	329	229	211	181	151	92	53	21	8	4	...	....	5,664	22.76
	1869	....	....	963	474	190	65	45	1,767	116	57	177	450	503	450	468	405	324	261	196	189	160	104	61	19	10	2	1	....	5,720	22.73
Local	1866	....	....	2,729	832	340	179	129	4,209	303	131	181	345	396	501	463	408	353	397	319	298	306	211	115	66	24	6	4	....	9,036	33.70
	1867	....	....	2,651	953	361	199	128	4,292	284	157	146	302	346	368	400	348	370	321	272	300	245	194	115	54	27	5	1	....	8,547	36.91
	1868	....	....	2,764	986	396	199	126	4,471	299	156	175	330	412	434	482	437	421	348	289	299	319	239	158	52	36	5	...	....	9,362	37.61
	1869	....	....	2,530	995	442	218	157	4,342	343	158	166	281	363	412	450	418	495	398	309	359	333	250	165	91	46	7	2	1	9,389	37.31
Developmental	1866	....	....	989	72	14	6	3	1,084	10	6	19	29	23	41	30	21	24	19	14	50	56	102	111	123	68	24	16	7	1,877	7.00
	1867	....	....	1,016	60	5	2	4	1,087	3	5	14	35	30	37	37	21	18	8	19	31	36	65	70	108	53	27	11	5	1,720	7.43
	1868	....	....	902	33	9	4	3	951	6	2	15	31	38	32	37	15	10	5	8	10	25	57	98	93	45	32	8	5	1,523	6.12
	1869	....	....	871	11	2	2	1	887	3	..	20	34	40	41	33	14	7	6	4	12	27	42	77	88	54	29	11	6	1,435	5.70
Violence	1866	....	....	99	20	30	15	9	173	78	36	38	63	85	107	95	83	45	40	25	37	19	8	5	2	2	...	...	....	939	3.50
	1867	....	....	99	17	20	17	10	163	52	42	36	70	61	61	114	63	44	30	16	10	19	7	4	3	1	...	...	....	796	3.44
	1868	....	....	100	20	25	21	16	182	46	43	42	53	79	98	101	75	59	28	23	26	9	12	6	..	2	...	...	....	884	3.55
	1869	....	....	68	26	29	24	16	163	60	47	27	61	97	88	85	97	81	59	20	23	14	8	7	5	2	2	1	....	947	3.77
Total	1866	16,631	10,184	7,769	2,722	1092	623	443	12,649	1023	418	673	1328	1419	1490	1390	1169	966	932	755	717	666	469	332	248	108	32	23	8	26,815	......
	1867	15,479	7,680	7,464	2,794	1056	587	373	12,274	753	346	469	1003	1080	1048	1180	899	847	676	543	567	493	375	260	196	98	35	12	5	23,159	......
	1868	16,805	8,084	8,157	2,888	1050	600	372	13,067	856	333	523	1043	1228	1186	1201	962	934	700	579	592	573	435	343	180	97	43	9	5	24,889	......
	1869	16,557	8,610	7,405	2,906	1295	733	520	12,859	941	354	498	1004	1180	1164	1199	1084	1008	836	611	658	594	435	340	216	117	44	17	8	25,167	......
Perc'tage on total mortality given by the deaths of both sexes in each period of life,	1866	62.02	37.98	28.97	10.15	4.07	2.32	1.65	47.17	3.82	1.50	2.51	4.95	2.29	5.56	5.11	4.36	3.60	3.48	2.82	2.67	2.48	1.75	1.24	.92	.40	.12	.08	.03	......	......
	1867	66.84	33.16	32.23	12.06	4.56	2.03	1.61	52.99	3.25	1.49	2.03	4.33	4.66	4.53	5.10	3.88	3.66	2.91	2.34	2.45	2.13	1.62	1.12	.85	.42	.15	.05	.02	......	......
	1868	67.52	32.48	32.77	11.60	4.22	2.41	1.49	52.50	3.44	1.34	2.10	4.19	4.93	4.77	4.83	3.87	3.75	2.81	2.32	2.34	2.30	1.75	1.38	.72	.39	.17	.04	.02	......	......
	1869	65.79	34.21	29.42	11.55	5.14	2.91	2.07	51.09	3.74	1.40	1.98	3.99	4.69	4.62	4.76	4.31	4.00	3.32	2.43	2.61	2.36	1.73	1.35	.86	.46	.17	.07	.03	......	......

NOTE.—492 colored persons died in the year 1869, of whom 250 were males and 242 females.

CONSOLIDATED ABSTRACT OF DEATHS IN BROOKLYN, FROM ALL CAUSES, REGISTERED FOR THE TWELVE MONTHS ENDING DECEMBER 31, 1869.

CAUSES OF DEATH.	MALES.																											
	NATIVITY.																											
	United States.	Foreign.	Under 1 year.	1-	2-	3-	4-	5-	10-	15-	20-	25-	30-	35-	40-	45-	50-	55-	60-	65-	70-	75-	80-	85-	90-	95-	100 and upward.	TOTAL MALES.
Class I.																												
ZYMOTIC DISEASES.																												
ORDER 1. (*Miasmatic Diseases.*)																												
Small-pox	12	....	4	1	2	1	1	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	12
Measles	129	3	26	59	25	7	6	9	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	132
Scarlatina	170	6	15	22	32	26	25	51	3	1	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	176
Diphtheria	68	1	15	16	5	15	7	7	2	1	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	69
Croup	93	6	15	22	24	14	13	11	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	99
Quinsy	1	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Whooping-cough	81	....	52	21	6	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	81
Typhus Fever	3	4	....	....	....	....	....	....	....	....	1	3	1	1	1	....	....	....	....	....	....	....	....	....	....	....	....	7
Typhoid Fever	27	24	....	2	3	1	2	5	4	3	8	1	3	4	....	5	1	2	3	2	1	1	....	....	....	....	....	51
Erysipelas	18	12	8	2	1	....	1	....	....	1	1	2	2	1	....	2	2	2	....	3	2	....	....	....	....	....	....	30
Pyæmia	7	7	....	....	....	....	....	1	....	2	1	1	1	2	....	2	1	1	1	1	....	....	....	....	....	....	....	14
Dysentery	64	19	25	17	11	3	2	5	1	....	1	2	....	2	3	2	3	....	....	2	2	....	2	....	....	....	....	83
Diarrhœa	95	12	68	25	2	1	....	....	....	....	1	1	1	....	2	....	1	....	....	2	2	1	....	....	....	....	....	107
Cholera Morbus	7	6	2	....	....	1	....	1	1	....	....	....	1	....	2	2	1	....	2	....	....	....	....	....	....	....	....	13
Cholera Infantum	390	8	276	116	4	1	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	398
Cerebro-spinal Meningitis	4	....	2	....	....	....	....	....	....	1	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	4
Remittent Fever	25	22	....	6	3	2	1	3	2	1	2	6	5	2	3	5	....	1	3	....	1	1	....	....	....	....	....	47
Intermittent Fever	3	5	....	....	2	....	....	....	....	....	1	1	....	....	1	....	....	1	....	1	....	1	....	....	....	....	....	8
Total Miasmatic Diseases	1197	135	508	310	120	74	59	96	13	10	16	17	15	13	12	18	9	7	9	11	8	5	2	....	....	....	....	1332
ORDER 2. (*Enthetic Diseases.*)																												
Syphilis	5	1	4	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	1	....	....	....	....	....	....	....	....	6
Hydrophobia	3	....	....	....	....	....	....	....	2	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3
Malignant Pustule	1	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Total Enthetic Diseases	9	1	4	....	....	....	....	....	2	1	....	....	2	....	....	....	....	....	1	....	....	....	....	....	....	....	....	10

CAUSES OF DEATH.	FEMALES.																												
	NATIVITY.		Under 1 year.	1-	2-	3-	4-	5-	10-	15-	20-	25-	30-	35-	40-	45-	50-	55-	60-	65-	70-	75-	80-	85-	90-	95-	100 and upward.	TOTAL FEMALES.	TOTAL BOTH SEXES.	Percentage of each cause on Total.
	United States.	Foreign.																												
Class I.																														
ZYMOTIC DISEASES.																														
ORDER 1. (*Miasmatic Diseases.*)																														
Small-pox	8	1	2	....	1	1	1	2	....	....	....	....	1	....	1	....	....	....	....	....	....	....	....	....	....	....	....	9	21	.23
Measles	127	3	25	55	19	7	9	13	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	130	262	2.98
Scarlatina	162	10	16	21	31	30	18	45	7	1	1	1	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	172	348	3.96
Diphtheria	66	4	5	16	14	10	6	13	1	....	2	1	....	....	....	....	2	....	....	....	....	....	....	....	....	....	...	70	139	1.57
Croup	75	2	13	10	17	14	9	12	1	....	....	....	....	....	1	....	....	....	...	....	....	....	....	....	....	....	....	77	176	2.00
Quinsy	1	......	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	2	.02
Whooping-cough	108	4	54	32	12	6	1	7	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	112	193	2.20
Typhus Fever	1	4	....	....	....	....	....	....	1	2	....	1	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	5	12	.13
Typhoid Fever	27	18	....	....	2	3	1	4	5	5	6	2	3	2	5	1	2	1	2	1	....	....	....	....	....	....	....	45	96	1.09
Erysipelas	18	7	13	1	1	1	....	....	....	1	1	1	....	2	1	1	1	....	....	....	....	1	....	....	....	....	....	25	55	.62
Puerperal Fever	7	29	....	....	....	....	....	....	....	2	7	11	7	7	2	....	....	....	....	....	....	....	....	....	....	....	....	36	36	.39
Pyæmia	4	1	....	....	....	....	....	2	1	....	....	1	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	5	19	.21
Dysentery	73	37	27	22	9	4	5	1	4	....	2	4	2	4	4	3	1	4	3	6	1	2	1	....	....	1	....	110	193	2.20
Diarrhœa	92	18	61	24	3	1	1	1	....	1	1	1	1	....	1	2	2	1	4	4	....	....	....	1	....	....	....	110	217	2.48
Cholera Morbus	6	8	1	3	....	....	....	1	....	....	....	....	1	1	....	2	....	1	1	1	2	....	....	....	....	....	....	14	27	.29
Cholera Infantum	407	7	281	126	6	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	414	812	9.27
Cerebro-spinal Meningitis	5	......	3	1	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	5	9	.10
Remittent Fever	29	11	1	3	4	6	5	2	3	....	2	1	3	4	1	....	1	1	3	....	....	....	....	....	....	....	....	40	87	.99
Intermittent Fever	3	1	....	....	....	1	....	1	1	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	4	12	.13
Total Miasmatic Diseases	1219	165	503	314	119	84	57	104	24	12	22	24	21	22	18	9	9	8	13	12	3	3	1	1	....	1	....	1384	2716	31.00
ORDER 2. (*Enthetic Diseases.*)																														
Syphilis	3	......	2	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3	9	.10
Hydrophobia	......	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3	.03
Malignant Pustule	......	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	.01
Total Enthetic Diseases	3	... ..	2	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3	13	.14

DEATHS IN BROOKLYN—Continued.

CAUSES OF DEATH.	MALES.																											
	NATIVITY.																											
	United States.	Foreign.	Under 1 year.	1-	2-	3-	4-	5-	10-	15-	20-	25-	30-	35-	40-	45-	50-	55-	60-	65-	70-	75-	80-	85-	90-	95-	100 and upward.	TOTAL MALES.
Class I.—Continued.																												
ORDER 3. (*Dietic Diseases.*)																												
Inanition, Privation, etc.	1	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	1	....	....	....	....	....	2
Want of Breast-milk	1	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Purpura	4	2	2	....	....	....	....	....	1	....	1	....	....	....	....	....	....	1	....	1	....	....	....	....	....	....	....	6
Intemperance	3	7	....	....	....	....	....	....	....	....	....	1	2	1	1	1	2	1	....	1	....	....	....	....	....	....	....	10
Delirium Tremens	5	14	....	....	....	....	....	....	....	....	1	1	2	5	5	2	1	1	1	....	....	....	....	....	....	....	....	19
Scurvy	1	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Total Dietic Diseases	15	24	3	....	....	....	....	....	1	....	2	2	4	7	6	3	3	4	1	2	....	1	....	....	....	....	....	39
Total Zymotic Class	**1221**	**160**	**515**	**310**	**120**	**74**	**59**	**96**	**16**	**11**	**18**	**19**	**21**	**20**	**18**	**21**	**12**	**11**	**11**	**13**	**8**	**6**	**2**	....	....	....	....	**1381**
Class II.																												
CONSTITUTIONAL DISEASES.																												
ORDER 1. (*Diathetic Diseases.*)																												
Gout	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Rheumatism	5	2	....	....	....	....	....	....	1	1	1	....	2	....	....	....	....	1	....	1	....	....	....	....	....	....	....	7
Dropsy	6	13	1	....	1	....	....	1	1	....	1	2	....	3	1	....	2	2	....	1	1	1	1	....	....	....	....	19
Cancer	1	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	1	....	1	....	....	....	....	....	....	3
" of Breast	2	1	....	....	....	....	....	....	....	....	....	....	....	1	1	....	....	....	....	....	....	....	1	....	....	....	....	3
" of Uterus	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
" of Stomach	10	13	....	....	....	....	....	....	....	....	....	....	1	....	....	1	1	5	7	5	2	1	....	....	....	....	....	23
" of Intestines	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	....	....	....	....	....	....	....	....	....	2
" of Liver	3	5	....	....	....	....	....	....	....	....	....	....	....	....	1	2	2	....	1	1	....	....	1	....	....	....	....	8
" of Ovary	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
" of Eye	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
" of Kidney	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
" of Mesentery	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
" of Neck	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	1
" of Face	....	2	....	....	....	....	....	....	....	....	....	....	....	....	1	1	....	....	....	....	....	....	....	....	....	....	....	2
Cancrum Oris	1	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Rachitis	2	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Total Diathetic Diseases	30	41	2	2	1	....	....	1	2	1	2	2	3	4	4	4	7	9	9	9	4	2	3	....	....	....	....	71

CAUSES OF DEATH.	FEMALES.																													
	NATIVITY.																													
	United States.	Foreign.	Under 1 year.	1-	2-	3-	4-	5-	10-	15-	20-	25-	30-	35-	40-	45-	50-	55-	60-	65-	70-	75-	80-	85-	90-	95-	100 and upward.	TOTAL FEMALES.	TOTAL BOTH SEXES.	Percentage of each cause on Total.
Class I.—Continued.																														
ORDER 3. (*Dietic Diseases.*)																														
Inanition, Privation, etc.																													2	.02
Want of Breast-milk																													1	.01
Purpura	1		1																									1	7	.07
Scurvy																													1	.01
Intemperance	1	9									1	1	2	2	1	1			1	1								10	20	.22
Delirium Tremens		6										1	2	1		1	1											6	25	.28
Total Dietic Diseases	2	15	1								1	2	4	3	1	2	1		1	1								17	56	.63
Total Zymotic Class	**1224**	**180**	**506**	**315**	**119**	**84**	**57**	**104**	**24**	**12**	**23**	**26**	**25**	**25**	**19**	**11**	**10**	**8**	**14**	**13**	**3**	**3**	**1**	**1**	.....	**1**	.....	**1404**	**2785**	**31.78**
Class II.																														
CONSTITUTIONAL DISEASES.																														
ORDER 1. (*Diathetic Diseases.*)																														
Rheumatism	4	4							1		2		2				1		1	1								8	15	.17
Dropsy	15	24				1				1		2	2	4	6	4	4	1	2	3	6	2	1					39	58	.66
Cancer	4	4									1						1	1	1	2		2						8	11	.12
" of Mamma	9	20										1		2	5	2	5	4	3	1	2	3	1					29	32	.36
" of Uterus	13	22									1	2	1	2	9	4	4	5	3	3		1						35	35	.39
" of Ovary		1																	1									1	1	.01
" of Stomach	5	7													1	3	3				3	1	1					12	35	.39
" of Intestines		3														3												3	5	.05
" of Liver	1	5													1			2	2	1								6	14	.15
" of Eye	1						1																					1	1	.01
" of Kidney	1				1																							1	1	.01
" of Mesentery	1															1												1	1	.01
" of Neck		2													1		1											2	3	.03
" of Face		1										1																1	3	.03
Cancrum Oris	1		1																									1	2	.02
Rachitis	4			3				1																				4	6	.06
Total Diathetic Diseases	59	93	1	3	1	1	1	1	1	1	4	6	5	8	23	17	19	13	13	11	11	9	3					152	223	2.54

DEATHS IN BROOKLYN—Continued.

CAUSES OF DEATH.	MALES.																										
	NATIVITY.																										
	United States.	Foreign.	Under 1 year.	1–	2–	3–	4–	5–	10–	15–	20–	25–	30–	35–	40–	45–	50–	55–	60–	65–	70–	75–	80–	85–	90–	95–	100 and upward.	TOTAL MALES.
Class II.—Continued.																												
ORDER 2. (*Tubercular Diseases.*)																												
Scrofula	3	....	1	....	....	1	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3
Tabes Mesenterica	231	10	156	56	13	3	2	3	1	1	....	....	1	2	....	1	....	1	....	....	1	....	....	....	....	....	....	241
Hydrocephalus	134	....	67	40	12	7	3	4	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	134
Phthisis	243	308	13	7	9	2	3	13	4	24	62	66	89	57	48	45	30	25	15	25	8	4	2	....	....	....	....	551
Tubercular Meningitis	36	6	17	7	3	5	1	2	....	1	2	1	2	....	....	1	....	....	....	....	....	....	....	....	....	....	....	42
Psoas Abscess	1	1	....	....	....	....	....	....	1	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Total Tubercular Diseases	648	325	254	110	37	18	9	22	7	26	65	67	93	59	48	47	30	26	15	25	9	4	2	....	....	....	....	973
Total Constitutional Class	**678**	**366**	**256**	**112**	**38**	**18**	**9**	**23**	**9**	**27**	**67**	**69**	**96**	**63**	**52**	**51**	**37**	**35**	**24**	**34**	**13**	**6**	**5**	....	....	....	....	**1044**
Class III.																												
LOCAL DISEASES.																												
ORDER 1. (*Nervous Diseases.*)																												
Meningitis	71	11	22	16	8	5	3	7	5	1	3	1	4	....	2	1	3	....	....	1	....	....	....	....	....	....	....	82
Softening of the Brain	11	7	1	1	....	....	....	....	....	....	....	1	....	....	1	....	2	6	2	1	....	1	1	1	....	....	....	18
Apoplexy	26	31	....	....	....	....	....	....	....	....	....	....	3	1	6	5	6	9	7	13	5	2	....	....	....	....	....	57
Epilepsy	6	3	....	....	....	....	....	....	....	1	1	....	1	2	....	1	2	....	1	....	....	....	....	....	....	....	....	9
Convulsions	248	8	179	38	13	13	4	6	1	....	....	1	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	256
Paralysis	17	17	....	....	1	....	....	2	....	....	....	2	1	2	1	2	4	3	3	3	2	3	2	3	....	....	....	34
Tetanus and Trismus	11	7	8	....	....	....	....	....	....	3	....	2	1	2	....	1	....	....	1	....	....	....	....	....	....	....	....	18
Congestion of the Brain	49	17	15	8	6	4	1	1	1	3	3	5	....	3	5	1	....	3	3	3	....	1	....	....	....	....	....	66
Tumor of the Brain	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Sun-stroke	....	2	....	....	....	....	....	....	....	....	1	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	2
Insanity	....	2	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	1	....	....	....	....	....	....	....	....	....	2
Total Nervous Diseases	439	105	225	63	28	22	8	16	7	8	8	12	10	11	16	11	18	22	17	21	7	7	3	4	....	....	....	544

CAUSES OF DEATH.	FEMALES.																												
	NATIVITY.																												
	United States.	Foreign.	Under 1 year.	1-	2-	3-	4-	5-	10-	15-	20-	25-	30-	35-	40-	45-	50-	55-	60-	65-	70-	75-	80-	85-	90-	95-	100 and upward.	TOTAL FEMALES.	TOTAL BOTH SEXES.	Percentage of each cause on Total.
Class II.—Continued.																													
ORDER 2. (*Tubercular Diseases.*)																													
Scrofula	7	1	4	....	....	....	....	1	1	....	1	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	8	11	.12
Tabes Mesenterica	204	9	125	57	16	4	4	1	1	....	....	1	....	....	....	....	1	....	....	1	1	1	....	....	....	....	....	213	454	5.18
Hydrocephalus	102	3	52	36	9	4	1	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	105	239	2.72
Phthisis	259	326	8	5	7	2	2	10	9	45	74	84	53	54	62	47	31	33	22	20	14	....	3	....	....	....	....	585	1136	12.96
Tubercular Meningitis	19	2	1	5	2	2	2	3	2	....	1	....	....	....	1	1	1	....	....	....	....	....	....	....	....	....	....	21	63	.71
Psoas Abscess	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	.02
Total Tubercular Diseases	591	341	190	103	34	12	9	18	13	45	76	85	53	54	63	48	33	34	22	21	15	1	3	....	....	....	....	932	1905	21.74
Total Constitutional Class	**650**	**434**	**191**	**106**	**35**	**13**	**10**	**19**	**14**	**46**	**80**	**91**	**58**	**62**	**86**	**65**	**52**	**47**	**35**	**32**	**26**	**10**	**6**	....	....	....	....	**1084**	**2128**	**24.29**
Class III.																													
LOCAL DISEASES.																													
ORDER 1. (*Nervous Diseases.*)																													
Meningitis	77	5	29	20	10	4	4	5	3	1	....	....	1	1	2	....	....	....	1	....	1	....	....	....	....	....	....	82	164	1.87
Softening of the Brain	6	4	....	1	....	....	....	....	....	....	....	....	....	....	2	....	....	....	1	3	1	1	....	1	....	....	....	10	28	.30
Apoplexy	24	26	2	....	....	....	....	....	....	....	1	2	1	2	4	2	2	5	10	6	6	3	2	1	....	....	1	50	107	1.21
Insanity	3	1	....	....	....	....	....	....	....	1	1	1	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	4	6	.06
Epilepsy	4	4	2	....	....	....	....	1	....	1	....	....	....	1	1	....	....	....	....	1	1	....	....	....	....	....	....	8	17	.19
Convulsions	221	4	147	48	10	6	2	2	2	1	2	1	1	1	1	....	....	....	....	....	....	....	....	1	....	....	....	225	481	5.10
Paralysis	18	15	....	....	....	....	....	1	....	....	....	....	1	2	3	2	3	4	2	3	3	2	4	3	....	....	....	33	67	.77
Tetanus and Trismus	7	1	7	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	8	26	.29
Congestion of the Brain	50	11	18	9	6	1	4	5	1	....	1	1	1	1	1	1	1	....	3	2	2	2	1	....	....	....	....	61	127	1.43
Tumor of the Brain	....	1	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	1	1	.01
Sun-stroke	1	1	....	....	....	....	1	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	4	.04
Total Nervous Diseases	411	73	205	78	26	11	11	14	7	4	5	5	5	8	15	5	7	9	17	15	15	8	7	6	....	....	1	484	1028	11.75

DEATHS IN BROOKLYN—Continued.

MALES.

CAUSES OF DEATH.	Nativity. United States.	Nativity. Foreign.	Under 1 year.	1-	2-	3-	4-	5-	10-	15-	20-	25-	30-	35-	40-	45-	50-	55-	60-	65-	70-	75-	80-	85-	90-	95-	100 and upward.	Total Males.
***Class III.**—Continued.*																												
Order 2. (*Circulatory Diseases.*)																												
Pericarditis	2	3	....	....	....	....	....	....	....	....	1	....	....	....	....	1	....	1	....	....	1	....	....	1	....	....	....	5
Aneurism	2	4	....	....	....	....	....	....	....	....	....	2	....	3	....	....	1	....	....	....	....	....	....	....	....	....	....	6
Valvular Disease	27	21	1	1	....	....	....	1	5	1	2	4	3	....	9	4	4	4	4	1	3	1	....	....	....	....	....	48
Syncope	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Heart-Disease	42	37	2	....	....	....	....	5	3	6	2	2	3	3	9	14	3	6	2	6	6	4	....	3	....	....	....	79
Phlebitis	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Total Circulatory Diseases	73	65	3	1	....	....	....	6	8	7	5	8	6	6	18	19	8	11	6	7	10	5	....	4	....	....	....	138
Order 3. (*Respiratory Diseases.*)																												
Laryngitis	8	3	1	....	5	....	....	1	1	....	....	....	....	....	1	1	1	....	....	....	....	....	....	....	....	....	....	11
Bronchitis	98	17	63	16	9	1	2	1	....	1	1	2	....	....	2	2	3	....	2	3	2	3	2	....	....	....	....	115
Pneumonia	207	112	83	48	14	9	6	6	2	7	11	13	10	10	10	22	12	12	17	11	12	4	....	....	....	....	....	319
Pleurisy	7	4	1	....	1	1	2	....	....	....	....	1	....	2	....	1	....	1	....	....	....	1	....	....	....	....	....	11
Hydrothorax	3	3	....	....	....	....	....	2	....	....	....	....	....	1	....	....	....	2	1	....	....	....	....	....	....	....	....	6
Empyema	2	1	....	....	....	....	....	1	1	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	3
Gangrene of the Lungs	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Congestion "	65	19	34	11	6	1	1	3	2	....	2	2	2	3	1	4	2	5	....	2	2	1	....	....	....	....	....	84
Emphysema (Asthma)	1	5	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	2	2	1	....	....	....	....	....	....	6
Total Respiratory Diseases	391	164	182	75	35	12	11	14	6	8	14	18	12	16	15	30	19	20	22	18	17	9	2	....	....	....	....	555

FEMALES.

CAUSES OF DEATH.	NATIVITY.		Under 1 year.	1-	2-	3-	4-	5-	10-	15-	20-	25-	30-	35-	40-	45-	50-	55-	60-	65-	70-	75-	80-	85-	90-	95-	100 and upward.	TOTAL FEMALES.	TOTAL BOTH SEXES.	Percentage of each cause on Total.
	United States.	Foreign.																												
***Class III.**—Continued.*																														
ORDER 2. (*Circulatory Diseases.*)																														
Pericarditis	6	1	....	....	....	1	....	1	1	1	....	....	....	....	....	....	1	....	1	....	....	....	1	....	....	....	....	7	12	.13
Aneurism	......	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	6	.06
Valvular Disease	30	25	....	....	....	....	....	3	5	6	4	....	4	2	2	5	4	3	4	4	4	1	2	2	....	....	....	55	103	1.17
Syncope	1	......	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	.01
Heart-Disease	41	36	2	1	....	1	....	3	2	1	1	6	6	7	4	5	4	9	6	5	7	4	3	....	....	....	....	77	156	1.88
Phlebitis	......	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	1	1	.01
Total Circulatory Diseases	78	63	2	1	....	2	....	7	8	8	5	6	10	10	6	10	9	12	11	9	12	5	6	2	....	....	....	141	279	3.17
ORDER 3. (*Respiratory Diseases.*)																														
Laryngitis	8	1	2	1	....	1	....	3	....	1	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	9	20	.22
Bronchitis	72	25	38	10	7	3	1	4	....	....	....	....	....	1	....	1	....	2	4	6	8	7	3	1	....	1	....	97	212	2.42
Pneumonia	183	75	54	38	21	9	3	16	7	3	5	6	5	12	7	3	9	11	12	15	10	9	1	2	....	....	....	258	577	6.58
Pleurisy	4	4	1	....	....	1	....	....	....	....	....	1	....	1	1	....	1	1	1	....	....	....	....	....	....	....	....	8	19	.21
Hydrothorax	4	4	....	1	....	....	....	....	....	....	....	....	....	2	1	....	....	1	1	....	1	1	....	....	....	....	....	8	14	.15
Empyema	......	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3	.03
Gangrene of the Lungs	1	1	....	....	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	2	2	.02
Congestion "	52	10	25	9	3	1	3	2	1	....	1	....	....	3	1	3	1	2	3	2	....	1	1	....	....	....	....	62	146	1.66
Emphysema (Asthma)	1	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	2	1	....	....	....	....	....	....	....	....	4	10	.11
Total Respiratory Diseases	325	123	120	59	31	15	7	25	8	4	6	7	5	19	12	8	12	19	22	23	19	18	5	3	....	1	....	448	1003	11.45

DEATHS IN BROOKLYN—Continued.

CAUSES OF DEATH.	MALES.																										
	NATIVITY.		Under 1 year.	1-	2-	3-	4-	5-	10-	15-	20-	25-	30-	35-	40-	45-	50-	55-	60-	65-	70-	75-	80-	85-	90-	95-	100 and upward.	TOTAL MALES.
	United States.	Foreign.																										
***Class III.**—Continued.*																												
ORDER 4. (*Digestive Diseases.*)																												
Gastritis	7	13	4	....	....	....	....	1	....	....	....	2	1	....	4	2	1	2	2	....	....	1	....	....	....	....	....	20
Enteritis	53	7	28	2	5	....	1	5	3	3	1	4	1	1	....	1	1	....	2	....	1	1	....	....	....	....	....	60
Peritonitis	10	9	2	1	1	....	....	1	....	4	1	2	4	2	....	....	....	1	....	....	....	....	....	....	....	....	....	19
Ileus	1	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Ulceration of Intestines	1	1	1	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	2
Hernia	3	7	1	....	....	....	....	....	....	....	....	....	....	....	1	1	3	....	1	1	1	....	1	....	....	....	....	10
Intussusception	1	2	1	....	....	....	....	....	....	....	....	....	....	1	....	....	....	1	....	....	....	....	....	....	....	....	....	3
Stricture of Œsophagus	....	2	....	....	....	....	....	....	....	....	....	....	....	....	1	....	1	....	....	....	....	....	....	....	....	....	....	2
Ulcer of the Stomach	3	1	....	....	....	....	....	....	....	....	1	....	1	....	....	....	1	....	1	....	....	....	....	....	....	....	....	4
Cirrhosis of the Liver	4	9	....	....	....	....	....	....	....	....	....	....	1	2	2	....	1	1	1	2	1	2	....	....	....	....	....	13
Hepatitis	12	18	1	....	....	....	....	1	1	....	....	3	1	2	5	5	4	1	1	2	1	2	....	....	....	....	....	30
Jaundice	12	2	12	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	1	....	....	....	....	....	....	....	14
Pharyngitis	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Disease of the Spleen	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Dyspepsia	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	1
Stricture of Rectum	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Total Digestive Diseases	107	72	50	3	6	....	1	8	4	7	3	12	9	9	13	11	12	6	8	6	4	6	1	....	....	....	....	179
ORDER 5. (*Urinary Diseases.*)																												
Nephritis	9	1	2	....	1	1	....	2	....	....	....	....	....	1	1	....	....	1	....	....	....	....	1	....	....	....	....	10
Nephria (Bright's Disease)	39	43	....	2	1	1	1	3	2	5	6	7	5	8	8	7	10	4	7	2	1	2	....	....	....	....	....	82
Stricture of Urethra	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	1
Diabetes	2	1	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	2	....	....	....	....	....	....	3
Cystitis	4	4	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	1	3	....	2	....	....	....	1	....	8
Total Urinary Diseases	54	50	2	2	2	2	1	5	2	5	7	7	5	9	9	8	11	5	8	5	3	4	1	....	....	1	....	104

FEMALES.

CAUSES OF DEATH.	NATIVITY.		Under 1 year.	1-	2-	3-	4-	5-	10-	15-	20-	25-	30-	35-	40-	45-	50-	55-	60-	65-	70-	75-	80-	85-	90-	95-	100 and upward.	TOTAL FEMALES.	TOTAL BOTH SEXES.	Percentage of each cause on Total.
	United States.	Foreign.																												
Class III.—Continued.																														
ORDER 4. (*Digestive Diseases.*)																														
Gastritis	12	19	3	....	1	....	....	1	1	2	2	....	4	2	2	2	2	4	2	1	2	....	....	....	....	....	....	31	51	.58
Enteritis	29	9	14	5	2	....	....	....	2	2	....	....	2	3	1	....	....	....	1	3	1	1	1	....	....	....	....	38	98	1.11
Peritonitis	8	19	....	....	....	....	....	1	1	....	4	4	6	1	2	2	....	3	1	....	2	....	....	....	....	....	....	27	46	.52
Ileus	1	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	....	2	3	.03
Ulceration of Intestines	......	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	1	3	.03
Hernia	2	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	....	....	1	....	....	....	....	....	....	3	13	.14
Intussusception	2	2	1	....	....	....	....	1	....	....	....	....	....	....	....	....	1	....	....	....	....	1	....	....	....	....	....	4	7	.07
Stricture of Œsophagus	......	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	....	....	....	....	....	....	2	4	.04
Ulcer of the Stomach	......	3	....	....	....	....	....	....	....	....	....	....	....	1	1	....	1	....	....	....	....	....	....	....	....	....	....	3	7	.07
Cirrhosis of the Liver	5	5	....	....	....	....	....	....	....	....	....	....	1	....	1	1	2	2	1	1	....	....	....	1	....	....	....	10	23	.26
Hepatitis	9	20	....	....	1	....	1	....	....	....	1	1	4	2	3	3	2	4	5	1	1	....	....	....	....	....	....	29	59	.37
Jaundice	5	4	4	1	....	....	....	....	....	....	....	....	....	....	1	1	....	1	....	1	....	....	....	....	....	....	....	9	23	.26
Pharyngitis	1	......	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	.01
Disease of the Spleen	1	......	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	.01
Dyspepsia	......	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	1	2	.02
Stricture of Rectum	......	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	1	1	.01
Total Digestive Diseases	75	88	23	6	5	....	1	3	4	4	7	5	17	9	11	9	10	16	10	9	8	4	1	1	....	....	....	163	342	3.90
ORDER 5. (*Urinary Diseases.*)																														
Nephritis	7	4	....	....	1	1	....	....	....	....	1	2	1	....	1	1	....	....	2	....	1	....	....	....	....	....	....	11	21	.23
Nephria (Bright's Disease)	28	26	1	2	....	....	....	2	1	2	5	8	5	5	4	5	3	2	3	5	....	....	1	....	....	....	....	54	136	1.66
Stone in the Bladder	......	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	1	1	.01
Diabetes	......	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3	.03
Stricture of the Urethra	......	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	.01
Cystitis	......	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	....	....	....	....	....	2	10	.11
Total Urinary Diseases	35	33	1	2	1	1	....	2	1	2	6	10	6	5	5	6	3	2	5	6	2	1	1	....	....	....	....	68	172	1.96

DEATHS IN BROOKLYN—Continued.

CAUSES OF DEATH.	MALES.																											
	NATIVITY.		Under 1 year.	1-	2-	3-	4-	5-	10-	15-	20-	25-	30-	35-	40-	45-	50-	55-	60-	65-	70-	75-	80-	85-	90-	95-	100 and upward.	TOTAL MALES.
	United States.	Foreign.																										
***Class III.**—Continued.*																												
ORDER 7. (*Locomotory Diseases.*)																												
Hip-joint Disease	6	2	1	....	....	1	1	2	1	....	....	1	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	8
Osteo-myelitis	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	1	....	....	....	....	....	2
Necrosis	1	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Spinal Disease	1	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Caries of Spine	3	....	....	....	....	....	....	2	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3
Total Locomotory Diseases	11	4	1	....	....	1	2	4	2	....	....	1	....	1	....	....	....	....	1	....	....	2	....	....	....	....	....	15
ORDER 8. (*Integumentary Diseases.*)																												
Phlegmon (Abscess)	10	2	5	1	1	....	....	1	....	....	1	....	1	....	....	....	....	....	....	....	2	....	....	....	....	....	....	12
Carbuncle	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	1
Skin-disease	1	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Total Integumentary Diseases	12	2	6	1	1	....	....	1	....	....	1	....	1	....	....	....	....	1	....	....	2	....	....	....	....	....	....	14
Total Local Class	**1087**	**462**	**469**	**145**	**72**	**37**	**23**	**54**	**29**	**35**	**38**	**58**	**43**	**52**	**71**	**79**	**68**	**65**	**62**	**57**	**43**	**33**	**7**	**8**	....	**1**	....	**1549**

CAUSES OF DEATH.	FEMALES.																												
	NATIVITY.																												
	United States.	Foreign.	Under 1 year.	1–	2–	3–	4–	5–	10–	15–	20–	25–	30–	35–	40–	45–	50–	55–	60–	65–	70–	75–	80–	85–	90–	95–	100 and upward.	TOTAL FEMALES.	TOTAL BOTH SEXES.	Percentage of each cause on Total.
***Class III.**—Continued.*																													
ORDER 6. (*Generative Diseases.*)																													
Ovarian Tumor	3	8	....	....	....	....	....	....	....	....	....	....	....	2	1	4	....	2	1	1	....	....	....	....	....	....	....	11	11	.12
Metritis (not puerperal)	....	10	....	....	....	....	....	....	....	1	1	....	1	3	1	1	2	....	....	....	....	....	....	....	....	....	....	10	10	.11
Uterine Tumor	2	2	....	....	....	....	....	....	....	....	....	....	....	1	....	2	1	....	....	....	....	....	....	....	....	....	....	4	4	.04
Total Generative Diseases	5	20	....	....	....	....	....	....	....	1	1	....	1	6	2	7	3	2	1	1	....	....	....	....	....	....	....	25	25	.28
ORDER 7. (*Locomotory Diseases.*)																													
Hip-joint Disease	1	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	9	.10
Osteo-myelitis	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	.02
Necrosis	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	1	2	.02
Spinal Disease	1	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	2	.02
Caries of the Spine	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	1	4	.04
Total Locomotory Diseases	2	2	....	....	....	....	....	1	....	....	1	....	....	....	....	....	....	1	1	....	....	....	....	....	....	....	....	4	19	.20
ORDER 8. (*Integumentary Diseases.*)																													
Phlegmon (Abscess)	5	4	4	....	....	....	....	....	....	1	....	2	....	....	....	....	....	1	....	1	....	....	....	....	....	....	....	9	21	.23
Carbuncle	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	1	2	.02
Skin-disease	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	.01
Total Integumentary Diseases	5	5	4	....	....	....	....	....	....	1	....	2	....	....	....	....	....	2	....	1	....	....	....	....	....	....	....	10	24	.26
Total Local Class	**936**	**407**	**355**	**146**	**63**	**29**	**19**	**52**	**28**	**24**	**31**	**35**	**44**	**57**	**51**	**45**	**44**	**63**	**67**	**64**	**56**	**36**	**20**	**12**	....	**1**	....	**1343**	**2892**	**33.00**

DEATHS IN BROOKLYN—Continued.

CAUSES OF DEATH.	MALES.																											
	NATIVITY.		Under 1 year.	1-	2-	3-	4-	5-	10-	15-	20-	25-	30-	35-	40-	45-	50-	55-	60-	65-	70-	75-	80-	85-	90-	95-	100 and upward.	TOTAL MALES.
	United States.	Foreign.																										
Class IV.																												
DEVELOPMENTAL DISEASES.																												
ORDER 1. (*Children.*)																												
Premature Birth	91	....	91	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	91
Teething	4	1	1	4	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	5
Cyanosis	23	....	23	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	23
Umbilical Hæmorrhage	3	....	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3
Malformation	21	....	21	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	21
Total Developmental Diseases of Children	142	1	139	4	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	143
ORDER 3. (*Age.*)																												
Old Age	13	35	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	4	5	16	12	4	3	1	1	48
Senile Gangrene	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	1
Total Diseases of Age	14	35	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	4	6	16	12	4	3	1	1	49
ORDER 4. (*Nutrition.*)																												
Debility	110	14	99	4	....	....	....	2	....	....	....	....	1	1	1	....	....	3	2	4	4	1	2	....	....	....	....	124
Total Diseases of Nutrition	110	14	99	4	....	....	....	2	....	....	....	....	1	1	1	....	....	3	2	4	4	1	2	....	....	....	....	124
Total Developmental Class	**266**	**50**	**238**	**8**	.....	.....	.....	**2**	.....	.....	.....	.....	**1**	**1**	**1**	.....	.....	**3**	**4**	**8**	**10**	**17**	**14**	**4**	**3**	**1**	**1**	**316**

CAUSES OF DEATH.	NATIVITY.		FEMALES.																											
	United States.	Foreign.	Under 1 year.	1-	2-	3-	4-	5-	10-	15-	20-	25-	30-	35-	40-	45-	50-	55-	60-	65-	70-	75-	80-	85-	90-	95-	100 and upward.	TOTAL FEMALES.	TOTAL BOTH SEXES.	Percentage of each cause on Total.
Class IV.																														
DEVELOPMENTAL DISEASES.																														
ORDER 1. (*Children.*)																														
Premature Birth	74	....	74	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	74	165	1.97
Teething	9	....	3	4	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	9	14	.15
Cyanosis	15	....	13	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	15	38	.41
Umbilical Hæmorrhage	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3	.03
Atelectasis Pulmonum	2	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	2	.02
Malformation	17	....	17	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	17	38	.41
Spina Bifida	1	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	.01
Total Developmental Diseases of Children	118	....	110	6	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	118	261	2.97
ORDER 2. (*Women.*)																														
Phlegmasia Dolens	....	1	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	.01
Childbirth	7	8	....	....	....	....	....	....	....	1	3	1	2	7	1	....	....	....	....	....	....	....	....	....	....	....	....	15	15	.17
Flooding	6	7	....	....	....	....	....	....	....	....	1	1	....	8	2	1	....	....	....	....	....	....	....	....	....	....	....	13	13	.15
Puerperal Convulsions	12	9	....	....	....	....	....	....	....	2	7	4	5	2	1	....	....	....	....	....	....	....	....	....	....	....	....	21	21	.23
" Mania	3	1	....	....	....	....	....	....	....	....	1	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4	4	.04
Rupture of Uterus	1	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	.01
Total Developmental Diseases of Women	29	26	....	....	....	....	....	....	....	3	13	9	7	18	4	1	....	....	....	....	....	....	....	....	....	....	....	55	55	.63
ORDER 3. (*Age.*)																														
Old Age	43	63	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	7	15	19	24	21	13	3	2	106	154	1.77
Senile Gangrene	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	1	2	.02
Total Diseases of Age	44	63	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	7	15	20	24	21	13	3	2	107	156	1.79
ORDER 4. (*Nutrition.*)																														
Atrophy	2	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	2	.02
Debility	86	20	75	2	1	1	....	....	....	....	....	....	....	....	....	1	3	3	1	6	3	2	5	2	....	....	1	106	230	2.62
Total Diseases of Nutrition	88	20	77	2	1	1	....	....	....	....	....	....	....	....	....	1	3	3	1	6	3	2	5	2	....	....	1	108	232	2.64
Total Developmental Class	**279**	**109**	**187**	**8**	**3**	**1**	....	....	....	**3**	**13**	**9**	**7**	**18**	**4**	**2**	**3**	**3**	**3**	**13**	**18**	**22**	**29**	**23**	**13**	**3**	**3**	**388**	**704**	**8.03**

DEATHS IN BROOKLYN—Continued.

CAUSES OF DEATH.	MALES.																										
	NATIVITY.																										
	United States.	Foreign.	Under 1 year.	1–	2–	3–	4–	5–	10–	15–	20–	25–	30–	35–	40–	45–	50–	55–	60–	65–	70–	75–	80–	85–	90–	95–	100 and upward.	TOTAL MALES.
Class V.																												
DEATHS BY VIOLENCE.																												
ORDER 1. (*Accidents and Negligence.*)																												
Fractures and Contusions	30	44	2	1	1	2	1	8	4	3	4	8	3	7	8	7	4	3	3	3	2							74
Incised Wounds	2	1						1	1					1														3
Gunshot "	2	7							1		1	5		2														9
Burns and Scalds	10	5	2	3	3					1		2		2				2										15
Poison by Paris Green		1											1															1
" by Arsenic	1															1												1
" by Opium	1	2											1	1		1												3
" by Morphine	1		1																									1
" by Lead	2	1												2				1										3
" by Potash	1			1																								1
Lightning		1																1										1
Compression of Brain		1												1														1
Suffocation	7	2	3	1				1		1				2			1											9
Drowning	16	23			1		1	4	4	3	4	2	2	6	5	4	1	1	1									39
Total Deaths by Accidents and Negligence	73	88	8	6	5	2	2	14	10	8	9	17	7	24	13	13	6	8	4	3	2							161
ORDER 3. (*Homicide.*)																												
Homicide	1										1																	1
Wounds		1												1														1
Gunshot Wounds	1													1														1
Incised "		1												1														1
Infanticide	2		2																									2
Total Deaths by Homicide	4	2	2								1			3														6

FEMALES.

CAUSES OF DEATH.	NATIVITY.		Under 1 year.	1-	2-	3-	4-	5-	10-	15-	20-	25-	30-	35-	40-	45-	50-	55-	60-	65-	70-	75-	80-	85-	90-	95-	100 and upward.	TOTAL FEMALES.	TOTAL BOTH SEXES.	Percentage of each cause on Total.
	United States.	Foreign.																												
Class V.																														
DEATHS BY VIOLENCE.																														
ORDER 1. (*Accidents and Negligence.*)																														
Fractures and Contusions	11	4	1	....	1	3	1	3	1	....	....	....	....	....	....	....	....	1	1	1	1	....	1	....	....	....	....	15	89	1.01
Incised Wound	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3	.03
Gunshot "	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	9	.10
By Vehicles in Streets	1	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	.01
Burns and Scalds	13	5	1	2	2	5	....	2	....	....	1	1	2	1	....	....	1	....	....	....	....	....	....	....	....	....	....	18	33	.37
Poison by Paris Green	....	1	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	2	.02
" by Arsenic	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	.01
" by Opium	....	1	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	4	.04
" by Morphine	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	.01
" by Lead	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3	.03
" by Potash	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	.01
Lightning	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	.01
Compression of Brain	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	.01
Suffocation	3	....	1	1	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3	12	.13
Drowning	2	2	....	....	....	....	....	1	....	....	....	....	....	....	....	1	1	....	1	....	....	....	....	....	....	....	....	4	43	.49
Total Deaths by Accidents and Negligence	30	13	3	3	5	8	1	6	1	....	2	1	3	1	....	1	2	1	2	1	1	....	1	....	....	....	....	43	204	2.33
ORDER 3. (*Homicide.*)																														
Homicide	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	.01
By Wounds	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	.01
" Gunshot Wound	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	.01
" Incised Wound	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	.01
Infanticide	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	.02
Total Deaths by Homicide	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	6	.07

DEATHS IN BROOKLYN—Continued.

CAUSES OF DEATH.	MALES.																										
	NATIVITY.		Under 1 year.	1-	2-	3-	4-	5-	10-	15-	20-	25-	30-	35-	40-	45-	50-	55-	60-	65-	70-	75-	80-	85-	90-	95-	100 and upward.	TOTAL MALES.
	United States.	Foreign.																										
Class V.—Continued.																												
ORDER 4. (*Suicide.*)																												
By Laudanum	......	2	......	......	....	....	....	....	....	....	....	....	....	1	1	....	....	....	....	....	....	....	....	....	....	....	....	2
" Drowning	1	1	......	......	....	....	....	....	....	....	....	....	....	....	1	....	....	1	....	....	....	....	....	....	....	....	....	2
" Hanging	3	2	......	......	....	....	....	....	....	1	....	....	....	....	1	1	....	1	....	....	1	....	....	....	....	....	....	5
" Shooting	5	1	......	......	....	....	....	....	....	1	....	2	....	1	....	....	....	2	....	....	....	....	....	....	....	....	....	6
Total Deaths by Suicide	9	6	......	......	....	....	....	....	....	2	....	2	....	2	3	1	....	4	....	....	1	....	....	....	....	....	...	15
ORDER 5. (*Sudden Death.*)																												
Cause unascertained	10	3	8	1	....	....	....	....	1	....	....	....	1	....	1	1	....	....	....	....	....	....	....	....	....	....	....	13
Total Deaths by Violence	**96**	**99**	**18**	**7**	**5**	**2**	**2**	**14**	**11**	**10**	**10**	**19**	**8**	**29**	**17**	**15**	**6**	**12**	**4**	**3**	**3**	....	....	....	....	....	....	**195**
Total Deaths from all Causes	**3348**	**1137**	**1496**	**582**	**235**	**131**	**93**	**189**	**65**	**83**	**133**	**165**	**169**	**165**	**159**	**166**	**123**	**126**	**105**	**115**	**77**	**62**	**28**	**12**	**3**	**2**	**1**	**4485**

CAUSES OF DEATH.	FEMALES.																													
	NATIVITY.		Under 1 year.	1-	2-	3-	4-	5-	10-	15-	20-	25-	30-	35-	40-	45-	50-	55-	60-	65-	70-	75-	80-	85-	90-	95-	100 and upward.	TOTAL FEMALES.	TOTAL BOTH SEXES.	Percentage of each cause on Total.
	United States.	Foreign.																												
Class V.—Continued.																														
ORDER 4. (*Suicide.*)																														
By Poison	......	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	1	1	.01
" Prussic Acid	1	......	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	.01
" Paris Green	......	1	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	1	1	.01
" Laudanum	......	1	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	3	.03
" Drowning	......	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	.02
" Hanging	......	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	5	.06
" Shooting	......	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	6	.07
Total Deaths by Suicide	1	3	....	....	....	....	....	....	....	....	1	1	....	....	1	....	....	...	1	....	....	....	....	....	....	....	....	4	19	.21
ORDER 5. (*Sudden Death.*) Cause unascertained	8	......	8	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	8	21	.23
Total Deaths by Violence	39	16	11	3	5	8	1	6	1	...	3	2	3	1	1	1	2	1	3	1	1	...	1	...	...	...	...	55	250	2.85
Total Deaths from all Causes	3128	1146	1250	578	225	135	87	181	67	85	150	163	137	163	161	124	111	122	122	123	104	71	57	36	13	5	3	4274	8759	100.00
Total of Both Sexes from all Causes	6476	2283	2746	1160	457	266	180	370	132	168	283	328	306	328	320	290	234	248	227	238	181	133	85	48	16	7	4	8759	8759	100.00

DEATHS FROM ZYMOTIC DISEASES.

BROOKLYN.—DEATHS FROM SMALL-POX, MEASLES, SCARLATINA, DIPHTHERIA, WHOOPING-COUGH, TYPHOID FEVER, TYPHUS FEVER, CHOLERA, CHOLERA INFANTUM, DIARRHŒAL MALADIES, AND OTHER ZYMOTIC DISEASES.

Registered during the Quarter ending Saturday, April 3, 1869.

WARDS.	Small-pox.	Measles.	Scarlatina.	Diphtheria.	Croup.	Whooping-cough.	Typhus Fever.	Typhoid Fever.	Cholera.	Cholera Infantum.	Cholera Morbus. Other Diarrhœal Diseases.	Remittent Fever.	Other Zymotic Diseases.	Total Deaths from Zymotic Diseases.	Deaths by Accident or Negligence. (Coroners' Inquests.)	Total Deaths from all Causes.
First	..	..	2	2	2	..	..	1	..	..	1	..	2	10	2	37
Second	..	2	1	2	2	..	..	..	..	..	1	..	1	9	1	42
Third	..	..	4	2	..	2	..	..	..	..	..	..	3	11	..	48
Fourth	..	..	3	2	2	..	..	1	..	..	1	..	2	11	..	62
Fifth	..	..	9	2	7	4	..	1	..	..	1	..	2	26	1	126
Sixth	..	1	8	6	4	..	..	2	..	..	..	2	2	25	6	152
Seventh	..	1	14	2	2	10	..	..	..	..	1	2	3	35	3	103
Eighth	..	1	1	2	2	8	..	1	..	..	..	2	1	18	4	60
Ninth	..	..	8	4	6	7	..	..	..	..	2	..	1	28	1	91
Tenth	..	..	11	4	1	4	1	1	..	..	3	1	3	29	2	162
Eleventh	..	..	10	..	..	3	..	1	..	..	2	1	3	20	5	140
Twelfth	..	..	5	6	1	1	..	..	..	..	2	..	2	17	4	86
Thirteenth	..	5	12	3	3	2	..	1	..	1	2	..	4	33	..	110
Fourteenth	..	3	7	8	5	2	..	1	..	..	4	..	..	30	2	131
Fifteenth	..	1	3	2	1	1	..	..	..	..	..	..	1	9	1	69
Sixteenth	..	1	9	2	7	10	2	..	..	..	1	..	4	36	..	157
Seventeenth	..	..	9	..	1	5	..	..	..	..	1	2	2	20	..	81
Eighteenth	..	..	..	1	1	3	..	..	..	..	..	..	1	6	3	38
Nineteenth	..	..	5	3	..	..	..	2	..	..	2	..	3	15	1	61
Twentieth	..	..	10	2	5	3	..	..	..	..		1	1	22	1	90
Twenty-first	..	..	16	1	1	3	..	2	..	1	3	1	1	29	3	101
Twenty-second	..	..	6	1	2	3	..	1	..	..	3	2	..	18	1	49
Totals	..	15	153	57	55	71	3	15	...	2	30	14	42	457	41	1,996

Registered during the Quarter ending Saturday, July 3, 1869.

WARDS.	Small-pox.	Measles.	Scarlatina.	Diphtheria.	Croup.	Whooping-cough.	Typhus Fever.	Typhoid Fever.	Cholera.	Cholera Infantum.	Cholera Morbus. Other Diarrhœal Diseases.	Remittent Fever.	Other Zymotic Diseases.	Total Deaths from Zymotic Diseases.	Deaths by Accident or Negligence. (Coroners' Inquests.)	Total Deaths from all Causes.
First	..	4	1	1	..	..	..	..	..	1	2	..	..	9	1	32
Second	..	5	1	1	5	2	..	1	..	2	1	..	..	18	2	72
Third	..	3	2	2	..	..	1	1	..	1	..	..	1	11	..	41
Fourth	1	1	4	..	..	..	1	..	..	1	2	..	..	10	..	49
Fifth	1	19	12	1	2	3	..	1	..	8	..	..	2	49	1	146
Sixth	..	16	12	6	1	1	..	4	..	13	11	1	3	68	8	195
Seventh	..	1	1	2	2	4	..	2	..	2	3	6	2	25	..	89
Eighth	..	3	1	3	..	..	..	..	..	3	1	2	1	14	3	56
Ninth	..	13	1	..	1	2	..	..	..	3	2	2	4	28	3	83
Tenth	..	9	9	2	5	1	..	2	..	7	8	1	2	46	1	147
Eleventh	..	10	5	1	4	6	..	5	..	2	1	..	9	43	3	124
Twelfth	..	3	4	2	3	..	..	..	..	11	4	2	1	30	6	116
Thirteenth	1	4	2	..	1	3	..	..	..	5	..	1	1	18	..	75
Fourteenth	..	3	6	4	2	1	..	1	..	10	5	1	2	35	..	113
Fifteenth	..	5	4	..	1	1	..	..	..	2	1	..	2	16	4	83
Sixteenth	1	6	14	2	4	8	..	2	..	13	4	..	6	60	3	178
Seventeenth	..	15	5	..	..	1	..	1	..	1	1	3	1	28	1	72
Eighteenth	..	4	1	..	1	..	..	..	..	2	3	..	1	12	..	36
Nineteenth	..	9	4	..	..	2	..	..	..	2	2	..	2	21	1	59
Twentieth	..	2	5	1	2	2	..	1	..	2	2	1	1	19	1	86
Twenty-first	..	1	9	..	..	3	..	..	..	4	1	1	4	23	1	100
Twenty-second	..	1	1	1	1	..	..	..	..	4	1	..	..	9	..	30
Totals	4	137	104	29	35	40	2	21	..	99	55	21	45	592	39	1,982

RETURN OF DEATHS FOR THE CITY OF BROOKLYN, FOR THE THREE MONTHS ENDING MARCH 31, 1869.

MONTHS.	MALES.	FEMALES.	NOT STATED.	TOTAL.	UNITED STATES.	FOREIGN.	NOT STATED.	TOTAL.
January..	319	304	......	623	458	165	......	623
February	314	303	......	617	435	182	......	617
March	384	373	......	757	557	200	......	757
Total	1,017	980	......	1,997	1,450	547	......	1,997

MONTHS.	Under 1 year.	1-2	2-3	3-4	4-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60	60-65	65-70	70-75	75-80	80-85	85-90	90-95	95-100	100 & upward.	TOTAL.
January....	163	54	34	22	20	39	15	14	25	27	28	20	29	20	18	11	17	25	15	10	9	4	2	1	1	623
February ..	167	59	33	28	11	34	10	6	16	24	32	28	30	28	24	17	19	15	14	3	12	5	2	....	.....	617
March......	191	66	51	29	21	47	13	21	29	38	28	38	20	30	24	26	23	13	21	13	8	6	....	2	.....	757
Total.....	521	179	118	79	51	120	28	41	70	89	88	86	79	78	66	54	50	53	50	26	29	15	4	3	1	1,997

RETURN OF DEATHS FOR THE CITY OF BROOKLYN, FOR THE THREE MONTHS ENDING JUNE 30, 1869.

MONTHS.	MALES.	FEMALES.	NOT STATED.	TOTAL.	UNITED STATES.	FOREIGN.	NOT STATED.	TOTAL.
April	207	212	......	419	296	123	......	419
May	402	337	......	739	514	225	......	739
June	438	385	......	823	627	196	......	823
Total	1,047	934	......	1,981	1,437	544	......	1,981

MONTHS.	Under 1 year.	1-2	2-3	3-4	4-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60	60-65	65-70	70-75	75-80	80-85	85-90	90-95	95-100	100 & upward.	TOTAL.
April	113	33	27	22	8	21	9	10	17	9	17	20	16	20	10	25	11	7	16	3	2	2	1	....	.....	419
May	170	93	47	20	19	37	6	25	29	47	32	26	24	25	29	20	21	21	22	7	3	4	2	....	.....	739
June	268	133	50	26	20	46	7	12	23	30	29	30	34	17	13	18	14	19	10	14	6	....	2	1	1	823
Total	551	259	124	68	47	104	22	47	69	86	78	86	74	62	52	63	46	47	48	24	11	6	5	1	1	1,981

DEATHS FROM ZYMOTIC DISEASES.

BROOKLYN.—DEATHS FROM SMALL-POX, MEASLES, SCARLATINA, DIPHTHERIA, WHOOPING-COUGH, TYPHOID FEVER, TYPHUS FEVER, CHOLERA, CHOLERA INFANTUM, DIARRHŒAL MALADIES, AND OTHER ZYMOTIC DISEASES.

Registered during the Quarter ending Saturday, October 2, 1869.

WARDS.	Small-pox.	Measles.	Scarlatina.	Diphtheria.	Croup.	Whooping-cough.	Typhus Fever.	Typhoid Fever.	Cholera.	Cholera Infantum.	Cholera Morbus, Other Diarrhœal Diseases.	Remittent Fever.	Other Zymotic Diseases.	Total Deaths from Zymotic Diseases.	Deaths by Accident or Negligence. (Coroners' Inquests.)	Total Deaths from all Causes.
First	..	..	1	1	..	..	..	..	..	4	3	..	..	9	..	16
Second	..	1	..	..	..	..	..	..	..	16	8	..	1	26	5	75
Third	..	..	2	..	1	3	..	..	..	10	3	1	..	20	..	37
Fourth	..	2	3	..	..	1	..	..	..	17	11	2	..	36	1	72
Fifth	3	1	5	1	..	4	..	1	..	36	12	1	2	66	1	171
Sixth	1	8	1	1	1	3	..	1	..	38	25	3	4	86	5	207
Seventh	..	4	5	..	..	2	..	2	..	26	6	2	3	50	1	108
Eighth	..	1	4	..	3	1	1	..	..	28	13	1	1	53	3	104
Ninth	..	3	2	1	2	2	..	1	..	32	11	4	1	59	1	143
Tenth	..	6	3	5	3	9	..	1	..	52	18	1	1	99	6	227
Eleventh	..	5	..	3	3	2	1	2	..	29	11	3	1	60	8	167
Twelfth	2	7	3	1	2	3	..	1	..	24	12	1	..	56	3	155
Thirteenth	..	1	..	..	1	3	..	1	..	32	3	1	2	44	1	107
Fourteenth	..	1	4	1	2	3	..	2	..	35	11	3	2	64	4	145
Fifteenth	..	3	2	1	..	5	..	..	..	38	15	..	2	66	5	137
Sixteenth	..	17	5	5	4	3	1	1	..	94	51	3	..	184	3	389
Seventeenth	..	10	2	1	3	2	1	..	..	34	17	1	..	71	3	139
Eighteenth	..	4	..	1	1	4	..	..	..	22	17	1	1	51	..	102
Nineteenth	..	6	..	2	2	4	..	1	..	27	10	..	..	52	8	112
Twentieth	..	5	1	..	1	3	1	..	..	21	12	..	1	45	1	90
Twenty-first	..	2	1	..	..	7	..	2	..	53	16	1	3	85	2	158
Twenty-second	..	..	..	..	1	..	..	..	..	12	5	..	1	19	...	51
Totals	6	87	44	24	30	64	3	16	...	680	290	29	26	1,301	61	2,912

Registered during the Quarter ending Saturday, January 1, 1870.

WARDS.	Small-pox.	Measles.	Scarlatina.	Diphtheria.	Croup.	Whooping-cough.	Typhus Fever.	Typhoid Fever.	Cholera.	Cholera Infantum.	Cholera Morbus, Other Diarrhœal Diseases.	Remittent Fever.	Other Zymotic Diseases.	Total Deaths from Zymotic Diseases.	Deaths by Accident or Negligence. (Coroners' Inquests.)	Total Deaths from all Causes.
First	..	..	1	..	1	1	..	1	..	..	..	1	..	5	..	23
Second	1	..	..	..	5	1	..	1	..	1	4	..	..	13	2	57
Third	..	1	1	2	1	..	..	2	..	..	2	..	..	9	..	32
Fourth	..	..	4	..	1	1	..	1	..	..	1	..	..	8	1	58
Fifth	3	..	6	2	2	..	..	1	..	..	6	..	2	22	3	124
Sixth	1	2	2	3	2	..	..	9	..	..	5	..	1	25	7	170
Seventh	..	1	1	2	2	..	1	..	..	..	1	1	2	11	1	74
Eighth	..	1	3	..	3	..	..	2	..	3	1	3	1	17	2	50
Ninth	..	..	..	1	1	..	..	1	..	1	1	..	1	6	2	63
Tenth	..	1	3	6	2	..	..	2	..	5	6	1	3	29	1	137
Eleventh	..	..	6	2	2	..	..	4	..	2	1	2	7	26	5	124
Twelfth	1	8	1	2	2	1	..	1	..	1	5	..	..	22	4	96
Thirteenth	1	..	1	1	1	3	..	3	..	1	3	1	2	17	2	76
Fourteenth	4	1	3	1	3	3	..	1	..	1	4	2	..	23	3	120
Fifteenth	..	1	4	1	3	1	..	1	..	1	1	..	..	13	2	73
Sixteenth	..	1	7	3	8	3	..	4	..	4	7	1	4	42	..	186
Seventeenth	..	..	4	1	1	1	..	5	..	1	1	2	1	17	..	77
Eighteenth	..	..	..	1	2	..	..	1	..	2	1	1	2	10	1	48
Nineteenth	..	..	..	..	3	..	..	1	..	..	3	..	3	10	3	63
Twentieth	..	..	..	2	7	1	..	..	..	..	..	1	1	12	1	83
Twenty-first	..	1	1	1	2	2	..	4	..	5	4	..	1	21	2	110
Twenty-second	1	2	..	..	1	..	..	..	..	3	..	..	..	7	..	30
Totals	12	20	48	31	55	18	1	45	..	31	57	16	31	365	42	1,874

RETURN OF DEATHS FOR THE CITY OF BROOKLYN, FOR THE THREE MONTHS ENDING SEPTEMBER 30, 1869.

MONTHS.	MALES.	FEMALES.	NOT STATED.	TOTAL.	UNITED STATES.	FOREIGN.	NOT STATED.	TOTAL.
July	589	554	......	1,143	968	175	......	1,143
August	456	441	......	897	712	185	......	897
September	450	422	......	872	652	220	......	872
Total	1,495	1,417	......	2,912	2,332	580	......	2,912

MONTHS.	Under 1 year.	1-2	2-3	3-4	4-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60	60-65	65-70	70-75	75-80	80-85	85-90	90-95	95-100	100 & upward.	TOTAL.
July	595	187	41	24	23	27	8	13	11	25	19	22	30	22	10	15	18	24	9	7	3	7	1	2	.....	1,143
August	353	178	40	13	9	17	15	12	21	27	20	18	33	16	19	25	13	19	16	10	6	8	....	....	.....	897
September	281	168	42	20	17	32	13	15	23	25	27	26	29	29	25	19	22	21	16	12	6	1	2	1	.....	872
Total	1,229	533	123	57	49	76	26	40	55	77	75	66	92	67	54	59	53	64	41	29	15	16	3	3	.....	2,912

RETURN OF DEATHS FOR THE CITY OF BROOKLYN, FOR THE THREE MONTHS ENDING DECEMBER 31, 1869.

MONTHS.	MALES.	FEMALES.	NOT STATED.	TOTAL.	UNITED STATES.	FOREIGN.	NOT STATED.	TOTAL.
October	373	348	......	721	499	222	......	721
November	306	320	......	626	415	211	......	626
December	316	364	......	680	457	223	......	680
Total	995	1,032	......	2,027	1,371	656	......	2,027

MONTHS.	Under 1 year.	1-2	2-3	3-4	4-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60	60-65	65-70	70-75	75-80	80-85	85-90	90-95	95-100	100 & upward.	TOTAL.
October....	184	94	35	26	16	30	11	19	22	25	30	33	28	31	18	21	25	22	14	20	9	4	2	2	.....	721
November..	148	62	29	23	9	22	12	10	40	22	24	29	17	26	25	32	27	27	16	13	7	4	1	....	1	626
December..	164	59	35	19	11	31	16	16	32	33	15	33	32	32	27	22	18	33	13	19	14	4	1	....	1	680
Total.....	496	215	99	68	36	83	29	45	94	80	69	95	77	89	70	75	70	82	43	52	30	12	4	2	2	2,027

DEATHS FROM ZYMOTIC DISEASES.

BROOKLYN.—DEATHS FROM SMALL-POX, MEASLES, SCARLATINA, DIPHTHERIA, WHOOPING-COUGH, TYPHOID FEVER, TYPHUS FEVER, CHOLERA, CHOLERA INFANTUM, DIARRHŒAL MALADIES, AND OTHER ZYMOTIC DISEASES.

Registered during the Year ending Saturday, January 1, 1870.

WARDS.	Small-pox.	Measles.	Scarlatina.	Diphtheria.	Croup.	Whooping-cough.	Typhus Fever.	Typhoid Fever.	Cholera.	Cholera Infantum.	Cholera Morbus, Other Diarrhœal Diseases.	Remittent Fever.	Other Zymotic Diseases.	Total Deaths from Zymotic Diseases.	Deaths by Accident or Negligence, (Coroners' Inquests.)	Total Deaths from all Causes.
First	..	4	5	4	3	1	..	2	..	5	6	1	2	33	8	103
Second	1	8	2	3	12	3	..	2	..	19	14	..	2	66	10	246
Third	..	4	9	6	2	5	1	3	..	11	5	1	4	51	..	158
Fourth	1	3	14	2	3	2	1	2	..	18	15	2	2	65	2	241
Fifth	7	20	32	6	11	11	..	4	..	44	19	1	8	163	6	567
Sixth	2	27	23	16	8	4	..	16	..	51	41	6	10	204	26	724
Seventh	..	7	21	6	6	16	1	4	..	28	11	11	10	121	5	374
Eighth	..	6	9	5	8	9	1	3	..	34	15	8	4	102	12	270
Ninth	..	16	11	6	10	11	..	2	..	36	16	6	7	121	7	380
Tenth	..	16	26	17	11	14	1	6	..	64	35	4	9	203	10	673
Eleventh	..	15	21	6	8	11	1	12	..	33	15	6	20	149	21	555
Twelfth	3	18	13	11	8	5	..	2	..	38	21	3	3	125	17	453
Thirteenth	2	10	15	4	6	11	..	5	..	39	8	3	9	112	3	368
Fourteenth	4	8	20	14	12	9	..	5	..	46	24	6	4	152	9	509
Fifteenth	..	10	13	4	5	8	..	1	..	41	17	..	5	104	12	362
Sixteenth	1	25	35	12	23	24	3	7	..	111	63	4	14	322	6	910
Seventeenth	..	25	20	2	5	9	1	6	..	36	20	8	4	136	4	369
Eighteenth	..	8	1	3	5	7	..	1	..	26	21	2	5	79	4	224
Nineteenth	..	15	9	5	5	9	..	4	..	29	17	3	5	98	13	295
Twentieth	..	7	16	5	15	9	1	1	..	23	14	3	4	98	4	349
Twenty-first	..	4	27	2	3	15	..	8	..	63	24	3	9	158	8	469
Twenty-second	1	3	7	2	5	3	..	2	..	19	9	2	1	53	1	160
Totals	22	259	349	141	175	193	11	97	...	814	430	83	141	2,715	188	2,912

NOTES ON THE CHIEF CAUSES OF DEATH.

Fevers.—Typhus was charged with 125 deaths in New York, and 11 in Brooklyn. Nearly all of these deaths occurred in hospitals. The only serious outbreaks of this disease occurred early in the year. The worst of the cases in Brooklyn came from the ship "James Foster, Jr.," but in the 17th Ward in New York the infection of typhus gained an entrance into certain inhabited cellars in December, 1868, and soon spread into the surrounding tenements, where a very filthy and overcrowded population was seriously threatened, until protection had been given them by thorough renovation and cleansing of the tenements, and by removal of the sick to hospital. The famished passengers of the ship "James Foster, Jr." were kindly taken into the Emigrant Refuge by the Commissioners of Emigration, thereby preventing much evil to city lodging-houses. Brooklyn received the officers of that infected ship, and after burying most of them, the same infection proved fatal to the physician and other attendants. The same unfortunate vessel sent its poisonous contagion to the Seaman's Retreat with a company of sick sailors, and the record of its deadly work in that institution was not ended until the lives of its chaplain and lastly its chief medical officer were sacrificed. With such lessons before us, the Board of Health has acted wisely in removing all typhus patients from crowded tenements in the city to the excellent pavilion hospitals of Blackwell's and Ward's Islands.

Typhoid or Enteric Fever.—The total number of deaths charged to this fever was 378 in New York, and 97 in Brooklyn. Some of these were not of the contagious type by which the true enteric typhoid or pythogenic fever is known. Yet some of the cases were well characterized in this respect. As this fever is liable to be both produced and diffused by foul sewers and privies, every outbreak of it has been treated by thorough disinfection of those sources and carriers of its poison. Sesquichloride of iron and heavy oil of coal-tar have been chiefly resorted to for this purpose. There has been no epidemic of this fever, but its spread in limited districts has been a source of much care to some of the medical officers. The necessity and usefulness of the fever hospitals during the past year have been strikingly exemplified. They are sanitary institutions of great importance, and, as the wards of these hospitals, both of the Commissioners of Public Charities and the Commissioners of Emigration, are models of pavilions, and the excellent administration of them has resulted in giving a rate of recoveries and a low death-rate that was never reached in private families and tenements, this fact is now so understood by the poor that we experience far less difficulty than formerly in removing their sick with fever from their tenements to the hospital.

Small-pox.—There were 206 deaths by this disease, of which 46 occurred in hospital, in the city and county of New York, while in Brooklyn and the Kings County hospital there were 30 deaths. The special report upon small-pox and vaccination, and the record relating to the disease and the prevention, are presented in Appendix A. The much-discussed question of the origin of the epidemic visitation of the disease, the past year, is best answered by barely stating the fact that the unvaccinated or imperfectly-vaccinated portion of the city population numbered more than 100,000 persons, and that to produce an epidemic of the disease simply required one circumstance, namely, that the contagion should be present in such places and things as could not be discovered beforehand and perfectly isolated or rendered inoperative. The one and peculiar feature of the epidemic has been that German immigrants have been the chief sufferers, and that, with the exception of the young infants in the German district, it has been an epidemic of varioloid. The epidemic district was not particularly characterized by an unusual proportion of unvaccinated persons, but by an unusual number of persons susceptible to the contagion. Possibly it might be proved that there was greater neglect and delay to vaccinate young infants, and to revaccinate adults, in the classes that suffered most. This, indeed, appeared to be the case.

The death-rate by small-pox was below the average of that for the last sixty years. It was 203 in 25,000, or a fraction over 8 in every 1,000 deaths.

Measles, Scarlatina, and Diphtheria.—The mortality caused by these foes of child-life was unusually heavy. They, together, destroyed 1,820 lives in New York, and 749 in Brooklyn. The course and fluctuations of scarlatina, week by week, are shown in the mortality charts facing page 247.

Diarrhœal Diseases.—Cholera Infantum.—The total mortality by these diseases in the year was 3,134 in New York; and, of this total, there were 1,509 charged to cholera infantum and entero-colitis. Infancy in the first year gave 1,883 of all the diarrhœal deaths. Childhood under five years gave a total o 2,676 deaths by the various kinds of diarrhœal disorders.

Syphilis.—Seventy-seven deaths were charged wholly to constitutional syphilis, and of this total there were sixty-three infants under five years. But this is only a fraction of the number of infants and others that would have been charged to this monstrous evil, except for the strong aversion of sufferers to allow the fatal operations of the constitutional taint to be known in their families or to be publicly registered by medical attendants. The neglect of needed legal restraint and compulsory care of the abandoned propagators of this disease, in cities and large towns, is resulting in the increase of an evil which mars and undermines the health and happiness of vast numbers of the innocent and the morally pure, as well as of the voluntary victims of sexual incontinence. In the city of New York this evil is the cause of much needless mortality—a vast amount of physical and social misery that ought not to be overlooked.

Glanders.—The registration of a single death by this disease, in a horse-keeper, requires a brief memorandum concerning this unusual entry in the death-register. The circumstances attending this instance of the disease, and similar facts that had been ascertained respecting two other fatal cases in horse-men during the previous year, led the Board of Health to adopt a special ordinance to prevent the keeping or having of any glandered horse in the cities and villlages of the Metropolitan District. This new sanitary ordinance [Section 174, Revised Ordinances] has brought the subject of glanders contagion under official inquiry and restraint.

Trichinosis.—The history of the poisoning of the inmates of the sailors' boarding-house, in which the fatal cases occurred, is briefly given by Sanitary Inspector Dr. C. F. Roberts, in another part of the report. The fact, that, with the trichinous parasite present in one tenth of all the swine-flesh which is sold in the market, from particular districts, such instances of poisoning or infection so seldom occur, should not encourage any neglect of watchfulness over the sources of unhealthful contamination of the food-supplies in our markets. Rude and insufficient kinds of cooking, or the gross habit of using certain flesh-foods uncooked, may be prevented by publicly making known the fatal results that occur, as in this instance. In Iceland, Dr. Arthur Leared reports that nearly 20 per centum of the mortality is caused by the common food-parasites.

Alcoholism.—*Mania a potu* and other fatal modes in which alcohol destroys its victims so unmistakably, and in such a public manner as not to admit of any other record than that of *alcoholism*, stands charged on the death registers in New York with 278 deaths, 181 of which were men, and 97 were women.

Want of Breast-Milk and Inanition.—This frequent and pitiable cause of death was certified in nearly three hundred instances, and might have been certified with entire truthfulness in nearly one thousand more cases that were accredited to tabes and infantile diarrhœa.

The Class of Zymotic Diseases.—This is a group of lethal agents that sanitary science is destined to control and greatly diminish by agencies adopted by people in their homes, as well as by Boards of Health in general reforms and preventive measures, and it still stands charged with thirty per centum of the deaths in New York and Brooklyn. Preventable as much of the mortality by this class of diseases is, much of it still remains inevitable. Croup, diphtheria, measles, scarlatina, and whooping-cough, do not yet come wholly under the control, though probably within the range, of preventive sanitary measures. The febrile contagions unquestionably will, in a more advanced state of sanitary knowledge and by the practice of strict domestic and public hygiene, be almost wholly restrained and expelled from well-ordered communities. But their restraint from an epidemic or spreading activity is now a leading duty in the sanitary police of cities.

The Class of Constitutional Diseases.—The worst type of this class is *cancer*. The several varieties of this formidable disease destroyed 305 lives; of these 226 were females. In her endurance of this misfortune, woman becomes the object of a kind of medical solicitude which makes it a duty to contribute whatever facts we can to the common fund of medical knowledge concerning the forms of *cancer* that are peculiar to her organization. The following abstract of the statistics of registered deaths by cancer of the uterine organs is presented here as a contribution to this purpose:

Abstract showing the Amount of Mortality by Malignant and other Organic Diseases of the Uterus and Ovaries, in three Periods, from 1804 *to October* 1, 1869, *sixty-five and three-quarter Years, in the City of New York.*

In the fifty-two years ending December 31, 1855, the following statistics of death are recorded:

Cancer of Womb.—None registered until 1837, when 6 deaths by that disease were reported, 7 in next year, 8 in next, and so on until 1855. The total number for the fifty-two years—but registered in only fifteen years of that period—amounted to 247.

Disease of Ovaries and Dropsy of Ovaries, counted together, caused 44 deaths during the same period.

Unclassified Diseases of the Womb.—Four deaths.

Cancer (in what part of body not stated) caused 1,209 deaths.

Tumor (in what part of body not stated) caused 189 deaths.

PERIOD.	Cancer of Uterus.							
	Under 25	25–30	30–35	35–40	40–45	45–50	50 or upward.	Total.
Ten years ending December 31, 1865......	9	18	9	7	139		168	431
1866, 1867, 1868, and first nine months of 1869	5	12	24	34	40	53	130	298

PERIOD.	Uterine Tumor.								Uterus Disease (undefined).							
	Under 25	25–30	30–35	35–40	40–45	45–50	50 or upward.	Total.	Under 25	25–30	30–35	35–40	40–45	45–50	50 or upward.	Total.
Ten years ending December 31, 1865.......	3	..	5	..	2	..	17	27	4	1	5	..	2	..	8	20
1866, 1867, 1868, and first nine months of 1869	..	..	..	1	6	2	7	16	2	4	2	1	1	..	..	10

PERIOD.	Ovarian Tumor.								Ovarian Dropsy.								TOTAL.
	Under 25	25–30	30–35	35–40	40–45	45–50	50 or upward.	Total.	Under 25	25–30	30–35	35–40	40–45	45–50	50 or upward.	Total.	
Ten years ending December 31, 1865.......	6	5	8	..	1	1	13	43	3	3	7		10		5	28	549
1866, 1867, 1868, and first nine months of 1869	2	1	1	2	2	6	7	21	5	4	6	3	5	9	10	42	387

In the ten years ending December 31, 1865, there was an average of 39 deaths yearly by "cancer," region and kind *not stated*, in females. In the three and three-quarter years ending October 1, 1869, there was an average of 37 such deaths, but in the last nine months only 15 such deaths. But it will be noticed above that there was a yearly average of 79 deaths by cancer of the uterus during the last (three and three-quarter years) period, and that the average in the previous ten years was only 43 per annum.

Again, we see that, counting fatal diseases of the womb and of the ovaries together in these two periods, we have a yearly average of 103 deaths in the latter period, and of 55 in the former or ten years' period. This is an instructive view of the case, but we have reason to believe that at least 25 of the 103 (yearly) would have been classified as uterine hæmorrhage, asthenia, etc., had not a searching criticism of death-certificates led to the correction of errors of such records.

The records of the past three years are probably as nearly correct, in point of accurate and faithful diagnosis and certificates, as could be wished.

Phthisis Pulmonalis.—There were 3,364 deaths from this disease registered. Of this number 1,748 were males, and 1,616 were females.

The mortality chart (facing page 247) shows that the weekly fluctuations in the line of mortality by this disease were less noticeable than those in any other lines in this chart showing the relative courses of causes of death.

The annexed table exhibits the registered records of annual mortality by this disease in New York for the last fifty years:

	1820.	1821.	1822.	1823.	1824.	1825.	1826.	1827.	1828.	1829.	1830.	1831.	1832.	1833.	1834.	1835.	1836.
Deaths by Pulmonary Consumption......	625	715	624	683	736	843	820	829	906	880	974	1033	1415	1251	1471	1437	1514

1837.	1838.	1839.	1840.	1841.	1842.	1843.	1844.	1845.	1846.	1847.	1848.	1849.	1850.	1851.
1,458	1,225	1,318	1,296	1,470	1,339	1,503	1,428	1,659	1,698	1,926	1,869	2,086	1,922	2,374

1852.	1853.	1854.	1855.	1856.	1857.	1858.	1859.	1860.	1861.	1862.	1863.	1864.	1865.	1866.	1867.	1868.	1869.	Total.
2487	2739	3032	2635	2478	2814	3046	3239	3186	3025	3170	3485	3615	3394	3402	3286	3414	3364	97,138

It appears that 97,138 deaths have been charged to this disease, in this city, in the last fifty years. The total number of deaths by all causes in this half century was 679,440. Hence, it appears that phthisis is charged 14.30 per centum of the total mortality. But our records show that in the last three years the totals of deaths by this disease have been as follows:

In 1867, 3,286 deaths, or 14.19 per centum of the total mortality.
1868, 3,414 " " 13.72 " " " "
1869, 3,364 " " 13.37 " " " "

Rigidly accurate methods of statistical registration of the causes of death have tended to prevent the less definite employment of nosological nomenclature that, until within the past two years, allowed many deaths to be credited to "*consumption*," that actually were caused by various chronic diseases other than tubercular phthisis. But whatever may be due to increased accuracy of medical certificates of causes of death, we still may be warranted in the conclusion that the rate of mortality by tuberculosis of the lungs is decreasing in New York. This, if true, is an important fact, and it may yet be demonstrated as it has been in the great towns of England, that although the decrease of fatal diarrhœas and fevers is the most obvious of the sanitary results which follow thorough drainage and drying of town sites, the decrease in pulmonary consumption is the most uniform and permanent of life-saving effects of such local improvements.*

In regard to the nativity of the decedents by phthisis the statistics show that the Irish-born New-Yorkers suffer more heavily than the American or the German, for that class is accredited with 1,479 out of the 3,364 deaths by this disease, while the German born gave only 525 deaths by this cause. That is (estimating last census basis), the Irish born suffered twice as heavily as the German born, and nearly twice as heavily as the adult American born. Concerning this, and various other points of practical interest, and especially in regard to the influence of unhealthful trades, and trades unhealthfully conducted, more will be known as such records accumulate.

A disabling, and distressing, and long-continued disease, that destroys 13.39 per centum of the total of all that die, and more than 27 per centum of the adult population in our cities, and, indeed, in all the Northern and Middle

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* Dr. John Simon, the Chief Medical Officer of the English Privy Council, has the following remarks on this subject in his Tenth Annual Report, 1868:

"Phthisis, so far as it depends on unwholesome circumstances of indoor industry, has, since my former reports, been made preventable under the law; and phthisis, so far as it depends on wetness of soil, may easily, in great part, be made similarly preventable.

"Distinction must, of course, here be drawn between populous and non-populous places. An undrained state of soil, in any place where population is aggregated, answers to the legal intention of the word 'nuisance;' and I apprehend that, even in the present state of the law, the local sewer-authority is bound to provide that such state shall not continue through want of proper constructions of drainage. For agricultural lands, no doubt, the case is different. It may not be practicable to require that such lands, though damp enough to cause phthisis to the comparatively few and scattered persons who reside on them, shall be artificially drained by their owners; and the interests of agriculture in this respect are not always identical with those of human salubrity. But, at least, the law might unequivocally condemn, so far as detrimental to health, all damming of natural drainage. And for river-conservancies, it would be a function scarcely, if at all, less important than that of preventing the pollution of rivers, that they should also, as far as possible, prevent or remedy all such artificial and natural obstructions of water-flow as keep tracts of inhabited land sodden with stagnant wetness."

ABSTRACT OF THE RECORD OF DEATHS BY PHTHISIS PULMONALIS, IN THE CITY OF NEW YORK, IN THE TWELVE MONTHS ENDING DECEMBER 31, 1869.

Showing Ages, Sexes, Nativity, and Classes of Occupations; also the Months and the Wards in which these Deaths occurred.

STATISTICS RELATING TO THE TOTAL OF THIS MORTALITY BY AGES AND SEXES.

AGES.	Male.	Female.	Total.
Under 1 year	2	4	6
1- 2 years	22	21	43
2- 3 "	14	16	30
3- 4 "	9	8	17
4- 5 "	5	5	10
5- 10 "	25	18	43
10- 15 "	17	22	39
15- 20 "	71	93	164
20- 25 "	199	241	440
25- 30 "	233	243	476
30- 35 "	237	188	425
35- 40 "	203	216	419
40- 45 "	184	149	333
45- 50 "	141	112	253
50- 55 "	115	68	183
55- 60 "	86	56	142
60- 65 "	77	50	127
65- 70 "	51	47	98
70- 75 "	34	32	66
75- 80 "	16	16	32
80- 85 "	6	8	14
85- 90 "	1	....	1
90- 95 "	....	2	2
95-100 "	....	1	1
Total	1,748	1,616	3,364

DIED IN HOSPITALS.

Bellevue Hospital	156
Other Hospitals	474
Total	630

DEATHS IN THE DIFFERENT MONTHS, AND THE NATIVITIES.

Months.	Male.	Female.	Total.
January	143	126	269
February	136	133	269
March	179	175	354
April	128	125	253
May	145	104	249
June	131	131	262
July	103	112	215
August	133	112	245
September	158	144	302
October	155	142	297
November	152	142	294
December	185	170	355
Total	1,748	1,616	3,364
NATIVITIES.			
Native	528	518	1,046
Ireland	696	783	1,479
Germany	338	187	525
Other Foreign Countries	186	128	314
Total	1,748	1,616	3,364
RESIDENCE IN THIS CITY.			
Less than five years	169	119	288
Five to ten years	136	146	282
Ten years and upward	828	775	1,603
Total	1,133	1,040	2,173
COLOR.			
Whites	1,690	1,558	3,248
Negroes	58	58	116
Total	1,748	1,616	3,364

OCCUPATIONS.

Physicians	5
Artists	4
Actors	4
Teachers (male)	3
Teachers (female)	11
Merchants	65
Clerks	139
Druggists	7
Publishers	2
Bookbinders	5
Brokers	6
Printers	34
Painters	36
Machinists (including blacksmiths and engineers)	65
Carpenters (including cabinet and piano makers)	104
Coopers	11
Butchers	25
Bakers	12
Tailors	52
Shoemakers	46
Barbers	23
Cigarmakers	18
Hatters	5
Masons	22
Stonecutters	8
Policemen	8
Firemen	4
Porters	18
Carmen and drivers	62
Seamen and boatmen	37
Pedlars	13
Laborers	256
Male servants	31
Female servants	241
Seamstresses	124
Other occupations	113
Total	1,619

DEATHS IN WARDS.

Wards.	Total.
1st Ward	68
2d "	5
3d "	9
4th "	114
5th "	61
6th "	124
7th "	132
8th "	129
9th "	185
10th "	126
11th "	213
12th "	179
13th "	114
14th "	131
15th "	61
16th "	151
17th "	262
18th "	154
19th "	464
20th "	208
21st "	304
22d "	170
Total	3,364

ABSTRACT OF THE RECORD OF DEATHS BY PHTHISIS PULMONALIS IN THE CITY OF BROOKLYN, DURING THE YEAR ENDING DECEMBER 31, 1869.

Showing Ages, Sexes, Nativity, and Classes of Occupations; also the Months and the Wards in which these Deaths occurred.

STATISTICS RELATING TO THE TOTAL OF THIS MORTALITY, BY AGES AND SEXES.

AGES.	Male.	Female.	Total.
Under 1 year	13	8	21
1– 2 years	7	5	12
2– 3 "	9	7	16
3– 4 "	2	2	4
4– 5 "	3	2	5
5– 10 "	13	10	23
10– 15 "	4	9	13
15– 20 "	24	45	69
20– 25 "	62	74	136
25– 30 "	66	84	150
30– 35 "	89	53	142
35– 40 "	57	54	111
40– 45 "	48	62	110
45– 50 "	45	47	92
50– 55 "	30	31	61
55– 60 "	25	33	58
60– 65 "	15	22	37
65– 70 "	25	20	45
70– 75 "	8	14	22
75– 80 "	4		4
80– 85 "	2	3	5
85– 90 "			
90– 95 "			
95–100 "			
Total	551	585	1,136

DEATHS IN THE DIFFERENT MONTHS, AND THE NATIVITIES.

MONTHS.	Male.	Female.	Total.
January	44	54	98
February	53	43	96
March	54	42	96
April	49	55	104
May	57	49	106
June	43	35	78
July	40	43	83
August	38	44	82
September	34	48	82
October	54	47	101
November	38	56	94
December	47	69	116
Total	551	585	1,136

NATIVITY.	Male.	Female.	Total.
United States	243	259	502
Foreign	308	326	634
Total	551	585	1,136

LENGTH OF RESIDENCE IN CITY, AND OCCUPATIONS.

Residence in this City.	Male.	Female.	Total.
Less than five years	96	101	197
Five to ten years	145	128	273
Ten years and upward	310	356	666
Total	551	585	1,136

OCCUPATIONS.

Educated Men (Professional)	17
Merchants	16
Clerks	19
Printers	24
Bakers	6
Laborers	176
Painters	25
Riggers	6
Shoemakers	18
Watchmen	6
Male Servants	28
Female Servants	164
Others, and not stated	631
Total	1,136

DEATHS IN WARDS.

Wards.	Total.
1st Ward	8
2d "	35
3d "	24
4th "	56
5th "	88
6th "	116
7th "	60
8th "	35
9th "	46
10th "	85
11th "	90
12th "	47
13th "	43
14th "	60
15th "	43
16th "	86
17th "	32
18th "	37
19th "	36
20th "	42
21st "	46
22d "	21
Total	1,123

States, should be so studied as to enable the people to overcome some great portion of the causes.

Diseases of the Brain and Nervous System.—The 297 deaths—nearly 12 per centum of the total mortuary list—charged to this group of maladies and accidents, is one of the least fluctuating of all the orders and classes in the nosological lists. "Convulsions," though unmeaning when registered without explanation, was the chief cause certified in 1,000, or about one-third of all this group of disorders. It was the name given to 987 deaths of children under five years of age, and in these cases it was mostly associated with fatal disorders of the bowels, or of the delicate tissues of the brain and nervous centres—a recognized and deplorable mode of dying.

Diseases of the Respiratory Organs.—Pneumonia and bronchitis caused nearly 500 more deaths than they had caused, on the average, in previous years. They together gave almost 12 per centum of the total mortality by all causes.

Deaths from Urinary Calculi.—There were only three deaths from this cause in the year 1869. The same number was registered for this cause in 1867; and only nine have been registered in the last four years. The records of mortality in New York the past seventy years present one very instructive fact, concerning the decrease of the deaths from "stone in the bladder." Whether such a result is attributable to the improvements in surgical diagnosis and treatment, or to the introduction of a grand supply of pure water into the city, or to certain improvements in the dietary of the people, may become an interesting question.

The registered facts are as follows: In the sixty-six years ending January 1, 1870, there were 145 deaths by "stone" and "gravel," in a total mortality, by all causes, amounting to 680,247 persons; while in the forty-two years that preceded, and included the year 1845, there were 117 deaths by this cause, in a total mortality amounting to 194,621 persons. And in the twenty-four years, from 1846 to 1869,* inclusive, *only twenty-eight deaths* occurred from "stone" and "gravel." The falling-off in this cause of death, so far as we can judge from the public registration, was rapid, and has been going on in this decrease ever since 1845. We have examined the vital statistics of other cities and countries, to find if the progress of surgical skill might not be accredited with this improvement, but no facts are found to warrant such a conclusion. The rate of mortality from urinary calculi in New York may now be stated as being three deaths annually in 1,000,000 inhabitants, or as 129 deaths in 1,000,000 of all that die. In England, the rate is seven deaths in 1,000,000 living, or 367 deaths in 1,000,000 of all that die.

It may be that the marvellous purity of the Croton water has contributed no small share to this favorable result in New York.

Nephria, or Bright's Disease.—This malady was registered as the cause of death in 559 cases, and of these there were 127 deaths in persons between forty and fifty years of age; and 353 were in persons of foreign birth.

Deaths by Violence.—Deaths by the various violent modes increase more

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* The supply of Croton water in this city dates from July 4, 1842. Well-water soon after that date fell into disuse throughout the city.

CLASSIFICATION OF CAUSES OF DEATH, CERTIFIED BY CORONERS, IN THE TWELVE MONTHS ENDING DEC. 31, 1869. CITY AND COUNTY OF NEW YORK.

WILFUL VIOLENCE.																ACCIDENTS AND NEGLIGENCE.																	DISEASES.										
SUICIDES.														HOMICIDES.												BURNS AND SCALDS.			DROWNING.		POISONING, NOT SUICIDAL.											
Laudanum.	Paris green.	Arsenic.	Morphine and opium.	Chloroform.	Cyanide of potassium.	Prussic acid.	Oxalic acid.	Poison, not stated.	Hanging.	Drowning.	By instruments.	Gunshot.	Other methods.	Gunshot.	Various other methods.	By casualties in the streets (exclusive of those by cars and other vehicles).	In and about buildings.	Casualties by and on wharves and shipping.	By railroad cars.	By other vehicles.	Fracture of skull and other parts.	Injuries not specified.	Unclassified injuries.	Strangulation and suffocation.	Exposure and want.	Burns by explosive fluids.	Burns by other causes.	Scalds.	Accidental.	Cause not ascertained.	Opiates.	Other poisons.	Alcoholism and intemperance.	Convulsions.	Apoplexy.	Congestion of lungs.	Asphyxia.	Diseases of the heart and other great blood-vessels.	Hydrophobia.	Effects of heat and *coup-de-soleil.*	Other diseases.	Infants under a week old.	Still-births found under suspicious circumstances.
5	13	4	2	1	3	1	1	4	20	8	13	24	3	5	32	41	153	15	60	27	53	16	52	26	10	11	52	41	172	......	8	10	90	137	93	7	21	163	2	13	742	83	234

Total Suicides	102
Total Homicides	37
Total Accidents and Negligence	747
Total Deaths by Opium and Narcotics	16
Total Deaths by Irritant and Corrosive Poisons	22
Total Deaths by Drowning	180
Total Diseases, including 234 Still-births	1,502
Total by Violence (physical and chemical)	139
Total of all causes, certified by Coroners	2,388

CLASSIFICATION OF CAUSES OF DEATH, CERTIFIED BY CORONERS, IN THE CITY OF BROOKLYN, IN THE TWELVE MONTHS ENDING DECEMBER 31, 1869.

WILFUL VIOLENCE.													ACCIDENTS AND NEGLIGENCE.																	DISEASES.								
SUICIDES.											HOMICIDES.												BURNS AND SCALDS.			DROWNING.		POISONING, NOT SUICIDAL.										
Laudanum.	Paris green.	Arsenic.	Opium.	Morphine.	Poison, not stated.	Hanging.	Drowning.	By instruments.	Gunshot.	Corrosive sublimate	Gunshot.	Various other methods.	By casualties in the streets (exclusive of those by cars and other vehicles).	In and about buildings.	Casualties by and on wharves and shipping.	By railroad cars.	By other vehicles.	Fracture of skull and other parts.	Injuries not specified.	Unclassified injuries.	Strangulation and suffocation.	Exposure and want.	Burns by explosive fluids.	Burns by other causes.	Scalds.	Accidental.	Cause not ascertained.	Opiates.	Other poisons.	Alcoholism and intemperance.	Convulsions.	Apoplexy.	Congestion of lungs.	Diseases of the heart and other great blood-vessels.	Effects of heat and *coup-de-soleil.*	Other diseases.	Infants under a week old.	Still-births found under suspicious circumstances.
2	2	..	..	3	4	4	6	4	10	2	5	8	4	12	2	12	12	13	10	42	10	2	6	10	14	21	31	2	3	19	77	19	19	40	2	275	22	130

Total Suicides	36
Total Homicides	13
Total Accidents and Negligence	206
Total Deaths by Opium and Narcotics	7
Total Deaths by Irritant and Corrosive Poisons	10
Total Deaths by Drowning	58
Total Diseases	603
Total by Violence (physical and chemical)	255
Total of all causes, certified by Coroners	858

rapidly than any other class, but probably not more rapidly than the increase of population. Yet there are some special causes that have fearfully increased in the past four years. The deaths by street accidents increase with the increased crowding of the population. The accidents by explosive naphthous oils used in lamps have likewise increased, and prior to the intervention of a sanitary ordinance, and the publication of results of the daily tests by the Board of Health, the deaths by this cause were becoming more and more numerous. In the month of July last five of these terrible and fatal burnings were registered in New York, in separate dwellings.

The foregoing abstract shows the statistical classification of the causes of death that have been investigated by coroners in the cities of New York and Brooklyn. (See p. 327.)

In submitting these statistics of the returns made by coroners, the fact is stated with much satisfaction that the uniform attendance of medical assistants at the inquests the past year has enabled the coroners to make returns which are far more definite and accurate than the average of this class of returns in previous years.

The rules which govern the registration of deaths, and the revision of medical certificates before the issuing of burial-permits, were published in a condensed form in the last annual report. Their practical adaptation to the end sought, viz., the insuring of all practicable accuracy in the certified vouchers for registration and the prevention of errors and wrong practices in regard to sudden, violent, and obscure deaths. These rules serve incidentally to reveal a vast amount of unhygienic management of the sick by irregular and incompetent practitioners, but no existing rules or statutes can prevent such practice.

Tenement-House Mortality.—The influence of bad housing and of overcrowding has been particularly noticed in our reports upon the mortality in each of the preceding three years. And as we last year presented results of a special and separate registration of deaths that occurred in tenement-houses, it is desirable now to present an abstract of the chief results that have been reached by this inquiry in the year 1869. The annexed abstracts and remarks relating to the mortality in tenement-houses are contributed by Mr. Norris R. Norton, the Chief Clerk in the Sanitary Superintendent's office, who has been charged with the duty of continually watching this kind of registration of sanitary facts. The registers in which these special records are kept are found to facilitate the daily inquiries that have to be made by the Sanitary Superintendent concerning the death-rates and the kinds of mortality in different quarters of the city, and in particular houses and blocks.

These studies of the records of mortality in tenement-houses have uses of the most practical character, both for immediate aid to the sanitary officers and for purposes that reach beyond the present. For in these inquiries there is being accumulated a mass of evidence that, with other lines of testimony, will ere long be in the nature of proof concerning both the preventable and the inevitable causes of the waste of life and the destruction of health and the social state among the industrial classes that crowd these tenement-dwellings. The ever-fluctuating and ever-excessive death-rate in the New York tenement population had come to be an urgent theme of hygienic inquiry; but it was not until we brought severe methods of analysis to bear upon the vital records of the population in each street, block, and house, and in particular groups of tenements, and not until, by means of a complete sanitary survey and census of every tenement-house and every block and street, that we could have at command the exact methods that sanitary science required for correctly estimating the influence and relations of the various physical circumstances which place human lives at the terrible disadvantage they suffer in the city tenement-houses.

In the Sanitary Superintendent's office may now be read at the same moment:

(1.) The yearly account with each tenement-house, as to the number and causes of death.

(2.) The census of every tenement-house, and a record of occupations* and various domestic and hygienic conditions of tenants.

(3.) The records of the sanitary survey of each house, showing its actual condition and hygienic defects as well as improvements.

(4.) The records and results of the official reports, complaints, and orders upon each house.

The achievement of this important result in this particular branch of sanitary duty will everywhere be regarded as a foundation for exact and useful efforts for the sanitary improvement which public and social economy require shall be effected in the housing of the dependent and industrial populations in cities and large towns. After twenty years of continuous and varied inquiry into the sanitary wants of our great cities, I unhesitatingly declare, my convictions in regard to the growing evils of bad housing and overcrowding lead me to estimate this subject as being the very first in importance for health authorities and a true spirit of philanthropy to grapple with. And as respects death-rates and the waste of life in these multiple and overcrowded tenement-dwellings, it is not so much the waste as it is the general damage and impairment of health, and the degradation of the physical and the social condition of families, that is the most deplorable.

In a preceding report [Appendix A] I have mentioned many facts upon this subject that may profitably be consulted by the reader of the following records which Mr. Norton has prepared. But so comprehensive and complete in themselves are these records, and so well has the assigned task of their analysis been executed, that it is not necessary to continue with this report any records of the individual houses, except such as Mr. Norton has mentioned as illustrations.

SPECIAL RECORDS OF THE MORTALITY IN TENEMENT-HOUSES.

Elisha Harris, M. D., *Sanitary Superintendent Metropolitan District.*

The records of mortality in tenement-houses, for the year 1869, were kept upon the plan that had been adopted for the previous year. The same topographical division of the city into districts was observed, and the same care and discrimination used in separating the certificates of death, and in posting up the account against each house, street, and district.

The plan provides for the registration of every death that occurs in tenement-houses, as these dwellings are defined in Chapter 908, Laws of 1867.* The record of each death contains a consecutive statement of the ward, the street, the number of the house, the number of families living therein, the age, nationality, sex, and social condition of the deceased person, together with the cause and date of death. A complete analysis of these records has not been attempted, for the reason that the period of time over which they extend is too short to give full value to such tabulated statistical statements of ages, sexes, nationalities, and causes of death, as are possible from this very interesting and important branch of vital registration.

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* Especially the domiciliary trades and all in-door trade industries.

The tables given in the Third Annual Report of the Metropolitan Board of Health were somewhat meagre, and contained only the results of the first nine months of this particular kind of labor; but they were sufficient to suggest the social as well as hygienic value which the record contains, and to open a broad field of inquiry for the statistician and also the student of science in its relation to the individual and to society. In this report we are able to compare the records for two entire calendar years; but even these must be presented in a partially undigested state, for the reason already stated. Nevertheless, as these records accumulate they increase in value, and, as they are permanent in form, it is not too much to hope that some future searcher into social laws will discover the importance of these registers of life and death in tenement-houses, and group them into such statistical forms as will reveal both the social and sanitary results of bad housing and overcrowding upon the wage-classes. This subject as yet remains almost wholly unstudied; for, notwithstanding all that has been written, we are even now only upon the boundary of a vast and uncultivated field which, under proper care and labor, must eventually yield an excellent harvest to any one who may patiently investigate these records of mortality for the purpose of finding the effect of this forced and unwilling closeness of companionship among the industrious poor upon the general welfare of society.

Another part of the plan for keeping these records of tenement-house mortality provided for an arbitrary division of the city into three districts, for the purpose of grouping together, as nearly as might be, those wards which, in their topography and population, had similar characteristics. This division proved to be exceedingly useful; for, by separating the population into classes, an opportunity was given of comparing death-rates among the best and the worst of those who are compelled to accept this kind of housing. As the record now stands, it seems to be more than probable that an excessive degree of overcrowding, among the better portion of the wage-classes, is more destructive to life and health than an excessive amount of dissipation and vice if coupled with a lesser degree of closeness of companionship. In the present state of knowledge of the effects of vice and overcrowding upon local death-rates, the difference appears to be in favor of the former. What proportion of mortality is due to vice, *per se*, and what due to the mere closeness of proximity of families and members of the same family, cannot, of course, be definitely stated in statistical terms; but, if it should be demonstrated that the overcrowded and virtuous poor are in more danger, day by day, from the enemies to life and health than their less crowded but more vicious neighbors—other sanitary circumstances being equal—the problem of reforming both classes, the one socially, the other physically, will be very materially simplified.

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* "A tenement-house, within the meaning of this act, shall be taken to mean and include every house, building, or portion thereof, which is rented, leased, let, or hired out to be occupied, or is occupied as the house or residence of more than three families living independently of another, and doing their cooking upon the premises, or by more than two families upon a floor, so living and cooking, but having a common right in the halls, stairway, yards, water-closets, or privies, or some of them." (Sec. 17, Chap. 908, Laws of 1867.)

TABLE SHOWING THE NUMBER OF DEATHS IN TENEMENT-HOUSES, AND THE NUMBER OF TENEMENT-HOUSES IN WHICH DEATHS OCCURRED, BY STREETS AND AVENUES, DURING THE YEARS 1868 AND 1869.

NAME OF STREET.	1868.		1869.	
	Number of Tenement-houses in which deaths have occurred.	Number of Deaths.	Number of Tenement-houses in which deaths have occurred.	Number of Deaths.
Albany Street	4	7	5	6
Allen Street	58	96	47	73
Amity Street	4	4	4	4
Amity Place	5	5	3	7
Ann Street	2	2	0	0
Attorney Street	42	60	27	40
Avenue A	101	165	146	221
Avenue B	85	133	98	150
Avenue C	92	130	59	95
Avenue D	20	25	18	25
Bank Street	5	5	2	2
Barrow Street	2	2	3	3
Batavia Street	4	7	3	3
Battery Place	2	2	0	0
Baxter Street	70	128	66	146
Bayard Street	24	44	25	58
Beach Street	3	3	4	5
Beaver Street	2	3	0	0
Bedford Street	5	6	1	1
Beekman Street	2	3	1	1
Benson Street	0	0	1	1
Bethune Street	2	3	2	5
Birmingham Street	4	5	2	5
Bleecker Street	20	26	16	18
Bowery	15	26	8	9
Bowling Green	0	0	1	1
Bridge Street	3	4	5	10
Broad Street	2	2	1	1
Broadway	82	45	13	14
Broadway Alley	3	3	1	1
Broome Street	72	88	75	108
Canal Street	39	56	34	43
Cannon Street	33	50	30	46
Carlisle Street	3	3	4	4
Carmine Street	13	15	7	11
Caroline Street	1	1	8	7
Carroll Place	2	2	1	2
Catharine Street	14	17	16	20
Catharine Slip	1	1	1	1
Cedar Street	8	9	10	17
Centre Street	13	17	14	21
Centre Market Place	5	5	4	6
Chambers Street	0	0	1	1
Charles Street	4	6	8	10
Charlton Street	28	33	21	31
Chatham Street	10	10	2	2
Cherry Street	161	280	119	230
Chestnut Street	0	0	2	3
Christopher Street	12	14	5	6
Chrystie Street	76	121	60	103
Church Street	1	1	1	1
City Hall Place	7	9	7	13
Clarke Street	11	12	8	12
Clarkson Street	12	13	9	11
Cliff Street	4	4	4	5
Clinton Street	52	77	48	85
Clinton Place	4	4	6	11
Collister Street	0	0	1	1
Columbia Street	32	44	28	36
Columbia Place	2	2	1	1
Commerce Street	1	2	1	2
Congress Street	3	3	2	2
Congress Place	0	0	1	1
Corlears Street	0	0	1	1
Cornelia Street	7	9	3	4
Cortlandt Street	0	0	2	6
Crosby Street	29	43	20	35
Delancey Street	78	128	77	107
Depeyster Street	1	1	0	0
Desbrosses Street	8	12	6	7
Dey Street	1	1	0	0
Division Street	45	55	34	44
Dominick Street	6	7	2	3
Dover Street	5	7	5	8
Downing Street	7	11	6	9
Doyer Street	2	3	3	3
Dry Dock Street	3	4	3	4
Duane Street	8	10	2	3
Durham Place	0	0	1	1
East Broadway	39	47	32	39
East Houston Street	70	99	89	130
East Fourth Street	101	157	89	152
East Eighth Street	67	85	55	84
East Ninth Steeet	93	121	68	109
East Tenth Street	54	72	59	85
East Eleventh Street	127	191	111	200
East Twelfth Street	103	160	90	148
East Thirteenth Street	79	131	87	146
East Fourteenth Street	66	124	51	116
East Fifteenth Street	21	40	40	78
East Sixteenth Street	49	72	53	92
East Seventeenth Street	37	69	34	63
East Eighteenth Street	36	72	21	49
East Nineteenth Street	30	43	23	29
East Twentieth Street	19	21	17	26
East Twenty-first St	29	48	17	26
East Twenty-second St.	35	51	40	65
East Twenty-third St	25	35	17	24
East Twenty-fourth St	26	43	26	37
East Twenty-fifth St.	30	32	17	29
East Twenty-sixth St	21	27	18	32
East Twenty-seventh St.	11	14	12	15

Table showing the number of Deaths in Tenement-houses, etc.—(Continued.)

NAME OF STREET.	1868.		1869.		NAME OF STREET.	1868.		1869.	
	Number of Tenement-houses in which deaths have occurred.	Number of Deaths.	Number of Tenement-houses in which deaths have occurred.	Number of Deaths.		Number of Tenement-houses in which deaths have occurred.	Number of Deaths.	Number of Tenement-houses in which deaths have occurred.	Number of Deaths.
East Twenty-eighth St.	36	57	27	35	Grove Street	6	8	1	1
East Twenty-ninth St.	23	34	21	32	Hague Street	2	2	2	5
East Thirtieth Street	8	9	11	14	Hall Place	0	0	3	5
East Thirty-first Street	25	35	29	44	Hamilton Street	20	28	15	27
East Thirty-second St.	33	44	35	46	Harrison Street	8	10	7	10
East Thirty-third Street	38	53	26	37	Henry Street	42	86	30	85
East Thirty-fourth St.	23	38	30	29	Hester Street	43	56	43	74
East Thirty-fifth Street	29	39	22	34	Hoboken Street	0	0	1	1
East Thirty-sixth Street	8	11	8	11	Horatio Street	5	8	7	11
East Thirty-seventh St.	13	18	11	13	Hubert Street	8	11	2	3
East Thirty-eighth St.	18	21	13	20	Hudson Street	53	61	44	53
East Thirty-ninth Street	12	15	11	16	Jackson Street	20	48	25	47
East Fortieth Street	9	10	5	5	Jacob Street	2	3	2	2
East Forty-first Street	21	32	18	23	James Street	30	49	22	44
East Forty-second St.	13	16	13	20	James Slip	1	1	2	2
East Forty-third Street	3	4	2	4	Jane Street	7	8	6	7
East Forty-fourth Street	2	2	1	1	Jay Street	3	3	4	4
East Forty-fifth Street	12	16	17	32	Jefferson Street	1	1	1	2
East Forty-sixth Street	25	30	27	40	Jersey Street	10	20	6	11
East Forty-seventh St.	35	44	24	37	John Street	1	1	0	0
East Forty-eighth St.	3	4	8	8	Jones Street	2	2	2	2
East Forty-ninth Street	0	0	4	4	King Street	15	18	18	32
East Fifty-first Street	3	4	1	1	Laight Street	7	8	8	8
East Fifty-second Street	0	0	9	10	Laurens Street	47	78	42	67
East Fifty-third Street	2	2	7	9	Leander Place	1	1	3	6
East Fifty-fourth Street	5	6	6	10	Leonard Street	33	52	24	48
East Fifty-fifth Street	0	0	3	4	Leroy Street	4	4	4	6
East Fifty-sixth Street	1	1	13	19	Lewis Street	63	86	46	71
East Fifty-eighth Street	0	0	1	1	Lexington Avenue	3	4	2	5
East Fifty-ninth Street	3	4	10	18	Liberty Street	4	10	5	6
East Sixtieth Street	1	1	3	4	Lispenard Street	5	6	3	3
East Sixty-second St.	1	1	4	4	Little Twelfth Street	8	17	9	13
East Sixty-sixth Street	0	0	3	4	Ludlow Street	72	122	55	89
East Seventy-fourth St.	0	0	7	10	Macdougal Street	3	4	7	12
East Seventy-seventh St.	0	0	1	1	Madison Street	97	163	81	155
East Seventy-eighth St.	0	0	1	1	Madison Avenue	2	2	0	0
East Eightieth Street	0	0	2	2	Mangin Street	7	12	9	14
East Eighty-first Street	0	0	1	1	Manhattan Street	3	7	1	1
East Eighty-second St.	0	0	2	2	Marion Street	16	23	9	11
East Eighty-third Street	0	0	2	2	Market Street	12	14	12	16
East Eighty-fourth St.	0	0	1	3	Mercer Street	5	8	7	8
East Eighty-fifth Street	1	1	4	4	Milligan Place	1	2	1	1
East Eighty-sixth Street	0	0	3	3	Minetta Street	3	4	5	5
East Eighty-seventh St.	0	0	1	1	Minetta Lane	3	4	6	7
Eighth Avenue	101	129	77	90	Mission Place	3	4	3	4
Eldridge Street	58	86	45	88	Monroe Street	91	146	78	128
Eleventh Avenue	63	82	53	63	Montgomery Street	15	23	6	9
Elizabeth Street	70	109	61	102	Morris Street	5	6	5	6
Elm Street	25	36	17	21	Morton Street	5	7	1	1
Essex Street	70	113	54	101	Mott Street	130	247	109	231
Extra Place	0	0	1	1	Mulberry Street	180	368	116	284
Fifth Street	136	199	110	186	New Bowery	2	3	5	6
First Avenue	211	319	232	325	New Chambers Street	7	12	7	10
First Street	25	33	12	15	Ninth Avenue	118	150	113	134
Forsyth Street	84	142	59	120	Norfolk Street	47	78	45	75
Fourth Avenue	12	15	8	8	North Moore Street	11	15	4	4
Frankfort Street	13	22	13	20	North William Street	1	1	0	0
Franklin Street	13	19	16	23	Oak Street	21	40	20	37
Front Street	2	3	8	14	Oliver Street	30	46	25	51
Fulton Street	2	2	0	0	Orchard Street	66	113	48	80
Gansevoort Street	12	16	14	19	Park Street	20	35	21	50
Garden Row	1	1	0	0	Patchen Place	2	3	0	0
Gay Street	0	0	1	2	Pearl Street	48	69	37	56
Goerck Street	34	49	23	45	Peck Slip	1	1	2	2
Gold Street	1	1	0	0	Pelham Street	0	0	2	3
Gouverneur Street	11	12	11	13	Pell Street	6	13	10	15
Grand Street	42	52	42	55	Perry Street	20	28	13	16
Greene Street	26	33	25	34	Pike Street	10	17	4	4
Greenwich Street	143	212	129	196	Pitt Street	44	61	50	85
Greenwich Avenue	17	21	6	8	Prince Street	21	31	26	8

Table showing the number of Deaths in Tenement-houses, etc.—(Continued.)

NAME OF STREET.	1868.		1869.	
	Number of Tenement-houses in which deaths have occurred.	Number of Deaths.	Number of Tenement-houses in which deaths have occurred.	Number of Deaths.
Reade Street	5	6	1	2
Rector Street	9	13	9	16
Renwick Street	3	3	4	4
Ridge Street	56	107	53	105
Rivington Street	76	116	70	103
Rivington Place	0	0	2	2
Robinson Street	2	3	1	1
Roosevelt Street	25	44	29	61
Rose Street	13	22	13	21
Rutgers Street	4	7	6	10
St. Mark's Place	10	13	6	6
Scammel Street	10	14	7	12
Second Street	89	144	71	112
Second Avenue	146	194	175	234
Seventh Street	55	81	56	77
Seventh Avenue	116	144	104	124
Sheriff Street	53	83	41	71
Sixth Street	129	182	110	171
Sixth Avenue	56	63	50	56
South Street	0	0	1	2
South William Street	0	0	1	3
Spring Street	53	70	35	56
Stanton Street	90	138	73	115
Staple Street	2	4	2	5
State Street	4	8	3	3
Stone Street	3	7	2	4
St. John's Lane	1	1	0	0
Suffolk Street	42	63	37	50
Sullivan Street	51	73	36	70
Tenth Avenue	114	153	119	156
Thames Street	4	5	6	10
Third Street	148	272	113	220
Third Avenue	189	224	184	223
Thomas Street	9	14	7	14
Thompson Street	47	84	42	69
Tompkins Street	0	0	1	1
Trinity Place	6	17	1	1
Union Court	2	2	2	2
University Place	1	2	0	0
Unclassified	270	489	398	398
Vandam Street	13	16	11	15
Vandewater Street	17	26	14	36
Varick Street	21	29	12	13
Vesey Street	2	2	1	1
Vestry Street	2	2	4	5
Walker Street	9	14	4	7
Wall Street	0	0	1	1
Washington Street	130	226	96	108
Water Street	52	75	53	87
Warren Street	1	1	0	0
Watts Street	21	28	18	23
Waverley Place	3	3	3	4
Weehawken Street	3	4	3	5
West Street	31	45	26	40
West Broadway	19	28	14	23
West Houston Street	35	47	29	43
West Fourth Street	7	10	4	7
West Ninth Street	1	1	0	0
West Tenth Street	19	24	11	18
West Eleventh Street	21	27	12	15
West Twelfth Street	8	12	9	11
West Thirteenth Street	20	24	20	34
West Fourteenth Street	3	4	2	2
West Fifteenth Street	9	9	12	20
West Sixteenth Street	51	82	40	54
West Seventeenth St.	50	68	46	60
West Eighteenth Street	34	48	25	37
West Nineteenth St.	43	62	41	60
West Twentieth Street	24	30	18	26
West Twenty-first St.	3	3	10	15
West Twenty-second St.	3	3	9	10
West Twenty-third St.	3	3	1	1
West Twenty-fourth St.	4	5	16	21
West Twenty-fifth St.	50	73	45	64
West Twenty-sixth St.	66	109	57	110
Wt. Twenty-seventh St.	74	117	60	92
West Twenty-eighth St.	57	86	61	99
West Twenty-ninth St.	59	87	57	83
West Thirtieth Street	51	76	36	57
West Thirty-first Street	52	71	35	46
West Thirty-second St.	50	71	48	76
West Thirty-third Street	55	72	39	56
West Thirty-fourth St.	2	2	5	5
West Thirty-fifth Street	53	68	38	46
West Thirty-sixth St.	49	62	37	48
West Thirty-seventh St.	43	48	28	36
West Thirty-eighth St.	39	43	27	40
West Thirty-ninth St.	57	85	53	102
West Fortieth Street	53	67	39	59
West Forty-first Street	75	119	53	81
West Forty-second St.	48	69	38	49
West Forty-third Street	37	47	25	33
West Forty-fourth St.	49	61	42	55
West Forty-fifth Street	26	33	17	24
West Forty-sixth Street	29	34	23	32
West Forty-seventh St.	28	38	22	29
West Forty-eighth St.	12	14	10	11
West Forty-ninth Street	20	29	13	19
West Fiftieth Street	8	13	17	33
West Fifty-first Street	19	21	6	6
West Fifty-second St.	28	36	24	39
West Fifty-third Street	32	37	25	34
West Fifty-fourth Street	10	13	18	19
West Fifty-fifth Street	1	1	1	2
West Fifty-seventh St.	3	3	1	1
West Fifty-eighth Street	0	0	2	2
West Fifty-ninth Street	3	3	1	1
West Sixtieth Street	1	2	0	0
West Sixty-third Street	1	1	0	0
West Seventy-third St.	0	0	1	1
West 129th Street	0	0	1	1
West Washington Place	3	5	2	8
White Street	1	1	0	0
Whitehall Street	2	3	2	4
Willet Street	56	97	43	81
William Street	19	27	8	10
Wooster Street	20	27	18	23
Worth Street	10	17	10	12
York Street	7	8	5	7
Total	9,602	14,550	8,853	13,285

TABLE SHOWING THE COMPARATIVE MORTALITY OF THE TENEMENT DISTRICTS IN EACH MONTH FOR YEARS ENDING 1868–'69.

MONTH.	1868.				1869.			
	First District.	Second District.	Third District.	Total.	First District.	Second District.	Third District.	Total.
January	296	485	378	1,159	272	456	389	1,117
February	266	398	333	997	267	402	333	1,002
March	263	429	342	1,034	289	433	372	1,094
April	277	426	369	1,072	262	408	341	1,011
May	277	421	327	1,025	216	329	312	857
June	233	361	307	901	272	400	350	1,022
July	518	894	846	2,258	362	632	591	1,585
August	443	804	684	1,931	351	553	552	1,456
September	337	520	469	1,326	283	429	405	1,117
October	246	410	371	1,027	264	383	352	999
November	243	321	322	886	275	379	393	1,047
December	246	354	334	984	246	388	344	978
Total	3,646	5,823	5,082	14,550	3,359	5,192	4,734	13,285
Total number of Deaths in 1868	5,761	6,900	12,228	24,889	6,040	6,781	12,346	25,167
Total Population Census of 1865	187,280	233,403	305,703	726,386	187,280	233,403	305,703	726,386
Total number of Dwelling-houses	13,259	11,808	24,777	49,844	13,259	11,808	24,777	49,844

The First District.—In order that these statistics may be more clearly understood, some general statement of the characteristics of each district needs to be made, and some account taken of the changes that have occurred in each since the last annual report.

The First District, which is bounded by the Bowery, Catharine Street, Fourteenth Street, and the East and North Rivers, comprises within these limits the 1st, 2d, 3d, 4th, 5th, 6th, 8th, 9th, 14th, and 15th Wards. It is the seat of much of the poverty, a great proportion of the crime, and nearly all of the vice of the city. Many other portions of the city have a bad and poverty-stricken population, but there is none where vice and poverty are so closely intertwined. Elsewhere the bad is mixed with the good in nearly equal proportions; but here the former always predominates, and there is but a small portion of the district, namely, the northwestern corner—the 9th and 15th Wards, and a part of the 8th Ward—wherein the major part of the people pursue the even tenor of virtuous and industrious lives.

The First District also comprises that portion of the city that is mainly devoted to commerce, and year by year this great civilizer drives a large number of families out of the old and filthy tenement-houses and narrow streets of the down-town wards into the better atmosphere and purer social circumstances of the region north of Fourteenth Street. By-and-by, massive, well-drained, well-lighted, thoroughly-ventilated, and highly-improved commercial warehouses and stores will take the place of the drinking-dens, dance-houses, rat-pits, lodging-houses, and brothels of this district, and the narrow, crooked, deformed, ill-conditioned, and yet overcrowded tenements which line the water-sides, will cease to harbor the wretched people who prey upon that unfortunate class of immigrants who remain in the city after the wiser and better classes have filtered through to homes in the West.

In its general characteristics the First District has not materially changed during the year. The opening of Church Street has ventilated the lower and western portion to a certain extent, diminished the population somewhat, and razed a number of rookeries which sheltered vice and disseminated disease. The Board of Health has let the fresh air and the glad sunlight into large numbers of dismal tenements, and caused many dark, damp, and unwholesome cellars to give forth their unclean inhabitants, compelling them to find more comfortable apartments; but, in spite of all, the lower portion of the district still remains the abode of the vicious poor—a class that no reform can reach, unless they are first driven from the dens they inhabit in idleness and vice, and are taught to love that virtue and industry they now appear to despise.

The Second District.—The Second Tenement-house District is bounded by the Bowery and Catharine Street, Fourteenth Street, and the East River, and comprises the 7th, 10th, 11th, 13th, and 17th Wards. Besides the natural increase in its population, this district has received, during the year, a great part of the overflow from the 1st, 2d, and 3d Wards, which have diminished somewhat in the number of their inhabitants, and are every year yielding more and more of the space occupied by dwelling-houses to the demands of commerce. But the influx of population to the Second District, though considerable, as shown by the more crowded condition of the tenement-houses, has not been sufficient to alter the general characteristics of the people as described in the last year's report.

The population of this district may be fairly estimated at fully one-third of the entire population of the city. This district comprises less than one-fourteenth of the area of the island. The population is exceedingly dense, and the houses are crowded. Not less than 350,000 persons, it is estimated, are here massed upon 942 square acres, including the area of the streets, making a population equal to 360 to the acre, or more than 230,000 to the square mile. But these figures do not fully state the facts concerning the density of the population on certain squares. Leaving the area of the streets out of the calculation, and taking some of the more populous portions, we find them crowded at the rate of nearly one thousand to the acre, and these masses of people are superimposed upon each other, layer upon layer, five, six, and seven stories high, each family having a common right in the halls, cellars, and water-closets, but deprived of the right to healthful homes by the very vice of the construction of the houses in which they are compelled to live.

The enforcement of the Tenement-house Law in this district has produced many excellent results. Some of the oldest and worst of the class of dwellings under consideration have been much improved by the addition of windows opening into dark bedrooms, and ventilators in the roof over the halls. Improvements have also been made by providing for the better drainage of premises and the adoption of a better system of water-closets and privy accommodations.

The Third District.—This district embraces all that portion of the city lying north of Fourteenth Street, and comprises within its limits the 12th, 16th, 18th, 19th, 20th, 21st, and 22d Wards. It has an area of 10,274 square acres, not including the Central Park and other public places, and a population amounting to 305,703 persons, according to the census of 1865. That portion of the district lying north of One Hundred and Forty-fifth Street is comparatively unpopulated, and embraces about 1,800 square acres. Notwithstanding the general salubrity of this portion of the city, it has many overcrowded and unwholesome spots—places that need constant sanitary attention, because of the local causes of complaint that have been allowed to spring up, and have been fostered, year after year, to the detriment of health and also to the depreciation of property value.

The Third District is cursed in some parts by offensive business pursuits that have always been, and probably will long continue to be, a nuisance to all who are compelled to live near them. The establishments wherein these obnoxious trades are carried on are such as to cheapen real-estate in their immediate neighborhood, and thus to reduce rents. They consequently become centres around which the very poor of every class agglomerate; and the final result is to have the evil of an atmosphere overloaded with foul and nauseating odors, superadded to the still more deadly foe to human health of overcrowding. The lack of ventilation, which is common to nearly all tenement-houses, is made still more fatal in such neighborhoods, even where there is a disposition to allow a free circulation of air through the apartments, and windows are kept closed for the purpose of shutting out odors that are too offensive to be endured.

The central portion of this district, namely, the belt extending from Seventh Avenue on the west, to Third Avenue on the east, and from Fourteenth Street to the Central Park, is favored beyond any other portion of the city for its healthfulness and general salubrity. It contains a great portion of the wealth and refinement of the city, and, although flanked on either side by masses of misery, poverty, and filth, escapes, year by year, with a death-rate scarcely more than fifteen in one thousand of the population. It is a perfect example of the effect of domestic and physical comfort in reducing local death-rates. The 15th Ward, although in another District, and far less highly favored in many respects, teaches the same lesson. Its inhabitants are well housed and well fed, and these domestic comforts save seven or eight lives in every one thousand inhabitants yearly that would undoubtedly be sacrificed if they were not relieved of the evils that inevitably pertain to our tenement-house system.

The Statistics of Tenement-House Mortality.—In presenting the statistics of the mortality in tenement-houses during the two years for which this special record has been kept, it has been deemed best to follow the general plan that was adopted last year. In accordance with this view the first tabular statement shows the number of tenement-houses in which deaths have occurred, and the number of deaths in these houses are presented street by street, in alphabetical order. The figures for the two years are placed side by side in such a manner as to show at a single glance the distribution of the tenement-house mortality, and the variations that have taken place in the two periods under consideration. This presentation is better adapted for reference and comparison of the relative mortality in the various streets of the city, which are more or less given up to the tenement-house population, than for purposes of analysis. It shows the streets wherein the influences that surround this class of inhabitants are most deadly, and points unerringly to those places wherein sanitary and social reform may reap the richest harvest.

The second table presents a statistical statement of the number of deaths in tenement-houses during the two years embraced in this report, as compared with the total mortality of each tenement-house district during the same periods; the number of tenement-houses in each district compared with the whole number of dwellings as given in the census of 1865; and the population of each district according to the same census. These data will form the basis of such deductions as may hereafter be made concerning the comparative mortality of tenement-houses, and it is believed will furnish inquirers with an excellent starting-point from which to make such studies of this subject in its social and physical relations to the total population as may seem to be justified by the importance of the subject.

In these tables the regularity that pervades the operation of the laws of health is admirably illustrated. Year by year, the same conditions produce similar results, and so death, year by year, in the same places, finds about the same number of victims. The equilibrium is preserved, and, if in one quarter there is a falling off in the mortality, the deficiency is made up in another. For what is gained in one season must be lost in another, until the art is learned of adapting ourselves to new conditions, or of making the environment harmonize with the physical organization. And this, after all, is the highest aim of sanitary science, namely, to secure to a given number of human beings, in all the varying seasons, such environment and sustenance as shall produce the highest and most permanent health, and the longest average duration of life. And the value of these statistics chiefly lies in the fact that they indicate the places where, and the conditions under which, human health is most in danger, and the average age of the dead lowest. They point out the very houses in which the laws of life and health are most frequently flouted and outraged; the streets and homes wherein disease and pestilence are welcomed; the people among whom healthy human life is most rarely to be found.

There was a gain in each of the three districts, during the year, as follows: First District, 286; Second District, 631; Third District, 348; in the city, 1,265. The gain in the public institutions was 153; the loss in dwellings other than tenement-houses, 1,793; while the increase in the total mortality of the city was 278. These figures show the variations that occurred during the two years under consideration, in the places that were visited by death. There was something which increased the chances of life among the classes who are compelled to live in tenement-houses, and to seek the shelter of the charitable institutions of the city during sickness; for, while the mortality among them was materially diminished, as compared with the previous year, there was a slight increase in the total mortality of the entire population of the city. What the improved lighting and ventilation of tenement-houses, under the operation of the law of 1867 had to do with this result, we will not undertake to say. If there were any connection between the two that could be actually demonstrated, it would probably read somewhat thus: Whereas, 39,272 windows were put into dark bedrooms of tenement-houses during the year; and, whereas, there was a saving of 1,265 lives in that portion of the population that lives in tenement-houses, it follows that one life was saved for every thirty-one windows so constructed.

Abstract showing the Distribution of Mortality in Tenement-Houses, in which three or more Deaths occurred, in the Year 1869.

STREET.	Houses in which 3 Deaths occurred.	Houses in which 4 Deaths occurred.	Houses in which 5 Deaths occurred.	Houses in which 6 or more Deaths occurred. *
Allen	31, 47, 94	51, 81, 195	....	....
Amity Place	....	10	....	....
Attorney	91, 155	....	....	....
Avenue A	16, 28, 31, 49, 66, 86, 187, 205, 216, 228, 246, 251, 277	26, 166, 203, 245, 335	....	....
Avenue B	41, 63, 74, 172, 182, 206, 217	174, 223, 250	....	162 (6)
Avenue C	133, 166, 181, 200, 201, 205, 208	172, 203, 206	207	....
Avenue D	....	....	4	....
Baxter	7, 93, 94, 113, 128	38, 61, 81, 90, 93	36, 36½, 57, 70, 92	14 (7), 35 (9), 79 (6), 119 (7),
Bayard †	88, 97	66, 69	....	64 (6), 102 (6), 107 (6)
Bethune	....	36	....	....
Birmingham	....	4	....	....
Bridge	....	....	....	1 (6)
Broome	24, 28, 154, 200, 286	22, 270	....	....
Canal	....	....	216	....
Cannon	99, 102, 120, 135	....	....	....
Carmine	....	75	....	....
Caroline	....	6	....	....
Catharine	63, 90	....	....	....
Cedar	102, 128, 129	....	....	....
Centre	46, 64	....	....	....
Charlton	48	....	....	....
Cherry	7, 14, 40, 48, 129, 151	21, 22, 32, 33, 38, 126, 142, 150, 222	19, 140, 141, 219, 400	18 (8), 36 (12), 137 (6) 139 (6)
Chrystie	15, 22, 165, 178, 214, 228	120	54, 163	....
City Hall Place	19, 24	....	....	....
Clarke	24, 26	....	...	....
Clinton Place	120	128	....	....
Clinton	18, 20, 23, 86	85, 87, 127	....	22 (6)
Columbia	91	....	....	....
Crosby	37, 45, 90	....	....	33 (6)
Delancey	42, 122, 135, 272	....	46	206 (6)
Division	97, 224	....	....	....
East Broadway	124	....	....	....
East Houston	62, 119, 260	311, 348, 391	254, 393	....
East Fourth	109, 120, 143, 193, 195, 203, 228, 238	145, 159, 170, 194, 219, 377	....	150 (6)
East Eighth	108, 117, 128, 309, 335, 376, 377	....	....	...
East Ninth	340, 435, 611, 639, 640, 642, 651	413, 629	....	....
East Tenth	362	254, 387	....	....
East Eleventh	302, 331, 337½, 414, 428, 436, 534, 637	526, 615, 630, 636, 643	333, 404, 512	420 (7), 426 (6), 432 (6)
East Twelfth	312, 402, 411, 429, 506, 518, 635, 641, 700	409, 425, 643	511, 625	....
East Thirteenth	341, 506, 522, 642	436, 442, 548, 632,	434	443 (7), 644 (9), 646 (6)
East Fourteenth	400, 406, 407, 417, 422, 423, 435, 437, 506, 508, 517, 528, 530, 604, 611,	436	418, 412, 534	404 (6), 519 (6)
East Fifteenth	427, 434, 436, 437, 503, 517, 523, 606	418, 510	408	....
East Sixteenth	402, 408, 551, 606	406, 510	425, 507	....
East Seventeenth	409, 429, 434, 502	405, 419	437	....
East Eighteenth	406, 415, 419, 425, 433	423, 435	408	416 (6)
East Nineteenth	427	....	....	....

* Numerals in parentheses show the actual number of deaths in the respective houses.

† Bayard, from Bowery to Baxter—38 tenement-houses contain 1,295 persons.

No.	Street.	Deaths.	Families.	Persons.	No.	Street.	Deaths.	Families.	Persons.
53	Bayard.	2	7	27	97	Bayard.	3	6	26
59	"	2	15	77	102	"	7	18	80
64	"	6	13	71	104	"	1	18	95
69	"	4	14	62	106	"	2	16	74
70	"	2	5	19	108	"	2	4	18
71	"	1	6	26	107	"	6	16	63
82	"	1	5	17	66	"	3	6	27
83	"	1	6	32					
86	"	2	8	27		17 houses.	48	169	762
88	"	3	6	21					

Abstract showing the Distribution of Mortality, etc.—(Continued).

STREET.	Houses in which 3 Deaths occurred.	Houses in which 4 Deaths occurred.	Houses in which 5 Deaths occurred.	Houses in which 6 or more Deaths occurred.
East Twentieth	408	....	....	....
East Twenty-first	404	221	....	....
East Twenty-second	145, 320, 328, 332, 335, 411	239	....	....
East Twenty-third	441	346	....	....
East Twenty-fourth	238	319	....	....
East Twenty-fifth	322	339, 414	....	....
East Twenty-sixth	340	....	331	....
East Twenty-seventh	....	318	....	....
East Twenty-eighth	339	....	....	....
East Twenty-ninth	....	223, 313	....	....
East Thirty-first	326, 342, 353	310	....	....
East Thirty-second	248, 307, 320	....	....	....
East Thirty-third	....	318, 345	....	....
East Thirty-fourth	330, 333	....	....	....
East Thirty-fifth	....	337	329	....
East Thirty-sixth	312	....	....	....
East Thirty-eighth	211	....	....	....
East Thirty-ninth	333, 337	....	....	....
East Forty-first	247	....	....	....
East Forty-second	152, 222	....	....	....
East Forty-third	200	....	....	....
East Forty-fifth	231	....	227	233 (6)
East Forty-sixth	232, 243	237	....	....
East Forty-seventh	228, 230	....	....	....
East Fifty-fourth	347	....	....	....
East Fifty-ninth	216, 232, 402	....	....	....
East Eighty-fourth	117	....	....	....
Eighth Avenue	583	....	....	....
Eleventh Avenue	584	559	....	....
Elm	41	....	....	....
Eldridge	47, 67, 69, 113, 128, 151, 190	73, 76, 157	74, 107	....
Elizabeth	75, 130, 174, 216, 241	8, 225	115	24 (6)
Essex	16, 35, 36, 45, 138, 148	10, 38, 43, 48	....	150 (7)
Fifth	413, 423, 429, 431, 436, 506, 517, 521, 527, 531	406, 525	408, 418, 512, 644	407 (6)
First Avenue	49, 91, 142, 160, 190, 262, 300, 344, 353, 354, 386, 785, 837, 948	336, 539	435, 831	193 (6)
Forsyth	21, 98	13, 186	17, 44, 73, 75	46 (7), 150 (6), 205 (6)
Frankfort	37	....	....	29 (6)
Franklin	16, 51	....	....	....
Front	289, 352	....	....	....
Goerck	3, 36, 37, 129	147	73, 75	....
Gouverneur	66	....	....	....
Grand	....	577, 583	....	....
Greene	....	69	....	....
Greenwich	112, 125, 133, 370, 417, 432	4, 114, 345, 463, 557, 607	101, 103	585 (6)
Hague	....	8	....	....
Hamilton	10, 45	....	38	....
Harrison	7	....	....	....
Henry	54, 56, 69, 74, 90, 120, 129	60, 77	94	42 (10), 75 (6), 80 (7), 92 (6)
Hester	87, 128, 167	12, 113	215	103 (7)
Horatio	....	....	4	....
Hudson	634	....	....	....
Jackson	32, 36, 42, 51	16, 37	34	....
James	24, 63, 66, 88, 102	61, 68	....	....
Jersey	....	....	12	....
King	71, 81	....	....	....
Laurens	67	33, 43	....	40 (7)
Leandert's Place	1, 2	....	....	....
Leonard	15, 23, 25, 128, 147	....	27, 143, 152	....
Lewis	....	49, 74, 83, 161	78	185 (6)
Lexington Avenue	....	203	....	....
Ludlow	24, 122, 144, 150, 164, 167, 172, 181	137	....	....
McDougal	2, 56	....	....	....
Mangin	71	....	....	....
Madison	35, 39, 116, 165, 169, 345, 347, 359, 361, 412	30, 174, 178, 202, 237	182, 350, 352, 390	307 (6)
Market	89	....	....	....
Monroe	87, 249, 263, 265, 311	33, 99, 142, 225	37, 237	242 (6)
Mott	17, 61, 63, 109, 156, 195, 200, 217, 221, 232, 250, 277, 308	15, 47, 73, 211, 234, 256, 299	49, 115, 134, 143, 231	60 (7), 65 (8), 102 (7), 281 (6)
Mulberry	20, 55, 64, 72, 113, 140, 171, 280, 284	49, 54, 59, 65	24, 31, 38, 53, 82, 235	5 (11), 8 (6), 9 (15), 37 (6), 41 (7), 47 (8), 51 (6), 60 (8), 89 (7), 108 (6), 115 (6), 233 (6)

Abstract showing the Distribution of Mortality, etc.—(Continued).

STREET.	Houses in which 3 Deaths occurred.	Houses in which 4 Deaths occurred.	Houses in which 5 Deaths occurred.	Houses in which 6 or more Deaths occurred.
New Chambers	66	....	....	....
Ninth Avenue	709	....	....	....
Norfolk	5, 63, 144	7, 28, 89, 154	117	....
Oak	11, 22	20, 32	38	....
Oliver	2, 5, 46, 51, 54, 66, 72, 74, 97, 117, 139, 166, 178, 187, 196	31, 33, 37, 64	24	43 (8), 93 (6)
Park	41, 50, 51, 89	....	....	39 (6)
Pearl	8, 326, 472, 476, 488	479	....	....
Pell	....	32	....	....
Pitt	72, 130	52	92, 137	31 (6)
Prince	163	156	....	....
Rector	33	....	26	....
Ridge	1, 21, 27, 32, 42, 96, 121, 125	38, 46, 109, 117	84,90, 108	....
Rivington	11, 152, 184, 194, 198	....	....	182 (6)
Roosevelt	11, 14, 16, 56, 123	....	10, 81	29 (6)
Rose	15	....	24	....
Rutgers	41, 60	....	....	....
Scammel	....	30	....	....
Second	3, 160, 164, 171, 186, 194, 196, 214, 235, 246, 288	199, 200	....	....
Second Avenue	26, 35, 515, 574, 634, 680, 865, 875, 1,003, 1,123	513, 595	....	....
Seventh Avenue	104, 132½, 239, 410	....	....	....
Sheriff	27, 58, 96, 112, 114, 120	38, 59, 79, 86	....	....
Sixth	312, 326, 404, 420, 434, 516, 523, 527, 537, 717, 725	513, 521, 524, 816	324	....
Spring	7, 54, 117, 119, 182	32	187	....
Stanton	42	13, 126	263	224 (9)
Staple	....	6	....	....
Stone	19	....	....	....
Suffolk	....	....	14	....
Sullivan	210, 228	67, 113	45, 213	41 (7)
Tenth Avenue	130, 218, 267, 269, 284, 307, 516, 572, 684, 746	....	....	....
Thames	....	24	....	....
Third	81, 110, 126, 131, 135. 138, 177, 180, 214, 216, 223, 243, 245, 253, 293	119, 122, 123, 185, 220, 247	108, 139, 212, 224	194 (6), 242 (7)
Third Avenue	863, 915, 917	....	....	445 (6)
Thomas	28, 40	....	....	....
Thompson	12, 28, 44, 57, 63	56	46, 59	....
Vandewater	12½	44	8	5 (6), 25 (6)
Walker	....	101	....	....
Wooster	177	....	....	....
West Broadway	40, 60	....	....	....
West Washington Place	....	60, 62	....	....
Whitehall	1	....	....	....
Washington	2, 15, 16, 29, 38, 99½, 129, 139, 439, 507, 757	10, 12, 37, 57, 101, 113	....	26 (7), 35 (8), 102 (6)
Water	343½, 358, 396, 656	658	410	616 (7)
Watts	54	....	....	....
West	413	17	....	....
West Houston	....	89, 97	....	300 (6)
Willett	22, 24, 82, 98, 119½, 121	31	122, 127	....
West Fourth	....	323	....	....
West Tenth	240, 256	242	....	....
West Thirteenth	251, 430	30½, 453	....	....
West Fifteenth	....	....	....	158 (6)
West Sixteenth	426	....	....	....
West Seventeenth	....	....	110, 325	....
West Eighteenth	154, 156, 228	230	....	....
West Nineteenth	131, 217	132	....	....
West Twentieth	204, 337	....	....	....
West Twenty-first	....	334	....	....
West Twenty-fourth	117	....	....	....
West Twenty-fifth	119, 300, 361	354	....	....
West Twenty-sixth	207, 333, 339, 341, 342, 344, 345, 353, 404, 437, 502, 543, 555	531	506	551 (8)
West Twenty-seventh	155, 220, 221, 224, 505	449	214	
West Twenty-eighth	104, 248, 434, 444, 452, 502	510	446	....
West Twenty-ninth	207, 529, 542	136	232	....
West Thirtieth	206, 210, 244, 254, 551, 553	....	....	....
West Thirty-first	143, 225, 243, 441	...	....	....
West Thirty-second	423, 446	448, 459	432	....

Abstract showing the Distribution of Mortality, etc.—(Continued).

STREET.	Houses in which 3 Deaths occurred.	Houses in which 4 Deaths occurred.	Houses in which 5 Deaths occurred.	Houses in which 6 or more Deaths occurred.
West Thirty-third	239, 241, 429	100	....	142 (6)
West Thirty-fifth	409, 413	....	....	....
West Thirty-sixth	527	....	....	....
West Thirty-seventh	304, 433	....	....	....
West Thirty-eighth	246, 313, 514	....	....	....
West Thirty-ninth	314, 316, 349, 408, 418, 421, 431, 432, 434, 435, 437, 439	405	333	433 (8)
West Fortieth	134, 302, 445, 447, 459	339, 448	....	...
West Forty-first	308, 479	....	....	423 (13)
West Forty-second	410	553	....	....
West Forty-third	322, 614	....	....	....
West Forty-fourth	332	....	....	....
West Forty-fifth	342	....	....	....
West Forty-sixth	....	414	....	....
West Forty-seventh	544	538	....	....
West Forty-ninth	424, 553	....	....	....
West Fiftieth	....	139, 141, 352	354	....
West Fifty-second	371, 421	569, 624	....	....
Total number of Houses	619	239	115	84
Total number of Deaths in these Houses	1,857	956	575	577

Death's Thoroughfares.—During the year 1868, the total number of deaths in the class of dwellings under consideration was 14,550, and these took place in 9,602 houses. In 1869, both these totals were reduced, and 13,285 deaths occurred in 8,853 houses. The table first presented shows the streets wherein those deaths occurred, and the number of tenement-house deaths in each street. Mulberry Street, for the second time, is found to be the most deadly in the city. Here death apparently holds continual carnival, with poverty, wretchedness, and filth, as aids. During the past year, 116 houses sent 284 persons to the grave, an average of 2.45 for every house that was visited by the destroyer. Mott Street, running parallel with Mulberry, fell a little behind in mortality, 109 houses yielding 231 deaths. Elizabeth and Baxter, both vying with the streets previously named, and contiguous to them, added largely to the mortality, the former giving 102 deaths in 61 houses, the latter 146 deaths in 66 houses. These streets are almost parallel with Broadway and the Bowery, and between the two. The finest street in the city, and one of the finest in the world, proves to be but a stone's throw from one of the most deadly. The tenement-houses in Avenue A also yield largely of fatal results. During the year there were 221 deaths in 146 houses; in Avenue B, 150 deaths in 98 houses; in Bayard Street, only seven blocks in length, there were 58 deaths in 25 houses; in Cherry, a street noted for its filth and wretchedness, 119 houses yielded 230 deaths; in Chrystie Street, 60 houses sent 103 persons to the grave. Delancey Street, in 1869, gave a mortality of 107 in 77 houses; in 1868, there were 128 deaths in 78 houses. In Madison Street the result of the comparison is not so favorable. In 1868, there were 163 deaths in 97 houses; in the following year, 155 deaths in 81 houses. The streets here mentioned are mainly in the Fourth, Sixth, and Fourteenth Wards; in other words, they pass through the very heart of the commercial portion of the city. They are crowded with a very improvident class, and are filthy to the last degree of civic uncleanness. The uniform nature of all the testimony in regard to the relations between filth, overcrowding, and the prevalence of disease, seems sufficient to prove that these local death-rates depend almost entirely upon local causes; for these conditions, wherever they are found, are followed in every case by similar results.

Table showing the Ages, Sexes, and Nativity, of Persons who died in Tenement-houses in the City of New York, during the Year ending December 31, 1869.

	NATIVITY.				Under 1 year.		1-		2-		3-		4-		Total under 5 years.	
	U. S.		Foreign.													
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
First District................	1185	1076	520	578	535	428	263	230	103	112	82	52	42	52	1025	874
Second District.............	1955	1713	756	768	988	793	420	345	185	162	92	102	62	75	1747	1477
Third District...............	1707	1673	621	733	860	766	350	352	153	128	69	79	56	72	1488	1397
Grand Total............	4847	4462	1897	2079	2383	1987	1033	927	441	402	243	233	160	199	4260	3748

	5-		10-		15-		20-		25-		30-		35-		40-	
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
First District...............	47	43	37	42	20	34	40	39	61	74	63	62	65	97	76	77
Second District	138	108	31	35	32	36	70	101	64	81	74	95	91	106	105	87
Third District...............	105	112	31	30	33	47	51	94	65	98	75	80	71	104	76	70
Grand Total............	290	263	99	107	85	117	161	234	190	253	212	237	227	307	257	234

	45-		50-		55-		60-		65-		70-		75-		80-	
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
First District...............	56	56	56	59	37	31	51	40	20	37	23	31	15	27	7	17
Second District.............	83	79	55	56	58	32	48	44	44	60	26	38	19	20	11	13
Third District....	91	66	65	54	45	46	35	53	31	53	29	37	20	31	7	18
Grand Total	230	201	176	169	140	109	134	137	95	150	78	106	54	78	25	48

	85–		90–		95–		100 and upward.		Total by Sexes.		Total both Sexes.
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	
First District..............	5	5	....	5	1	2	....	2	1705	1654	3,359
Second District............	8	9	3	3	3	....	1	1	2711	2481	5,192
Third District	4	7	3	7	3	2	....	....	2328	2406	4,734
Grand Total	17	21	6	15	7	4	1	3	6744	6541	13,285

Age, Sex, and Nativity, of the Tenement-House Dead.—During the year 1869, there were deaths of 6,744 males and 6,541 females in the tenement-houses of New York. Of the whole number, 4,847 males and 4,462 females, 70 per cent. of the whole, were natives of the United States, and 1,897 males and 2,079 females, or the remaining 30 per cent., were foreign born. Much the larger portion of the latter class were of adult age, which suggests the somewhat curious fact that more foreign-born women than men die in tenement-houses, notwithstanding the greater mortality among males than among females. Of the native born, the great majority was made up of young children, 33 per centum of all the deaths being infants under one year old, and 60 per centum of the total under five years of age. These statistics show the terrible fatality to child-life that exists among our tenement-house population. Children have greater need of pure air than adults, for the latter have a power of resisting certain predisposing causes of sickness which speedily overwhelm and destroy the former. Furthermore, they have proportionately a greater capacity for contaminating the air than adult persons, which accounts for the greater need of well-ventilated rooms where there are young children. These facts need to be remembered among all classes, for everywhere there seems to be an hallucination which leads mothers into the fatal error of asphyxiating their children rather than to allow the pure breath of heaven to visit their cheeks too roughly.

From five to fifteen years, life even here seems tolerably safe. At these ages both sexes spend much of their time in the open air, and thereby escape many special foes of life to which children of more tender years are continually exposed. What these ages suffer from most is the demoralizing influences that arises from the fact that, while they are in the house, they are compelled to the companionship of adults of both sexes, and this is the period at which tenement-house life produces its direst social results. Life and health are not in special jeopardy, but the moral natures of both sexes are utterly destroyed. In these years the passions get an unnatural growth, and the victims of this pernicious system of housing spring into a precocious man-and-womanhood before they have ceased to be boys and girls. Witness the faces and the manners of the young of both sexes who are to be met with in the more crowded tenement-house districts.

TABLE SHOWING THE TOTAL MORTALITY OF THE CITY, AND THE COMPARATIVE MORTALITY IN TENEMENT-HOUSES, PRIVATE RESIDENCES, HOTELS, BOARDING-HOUSES, AND IN THE PUBLIC INSTITUTIONS, IN EACH WEEK, FOR YEARS 1868 AND 1869.

WEEK ENDING	1868. Public Institutions.	1868. Private Houses, Hotels, and Boarding-houses.	1868. Tenement-houses.	1868. Total Mortality.	WEEK ENDING	1869. Public Institutions.	1869. Private Houses, Hotels, and Boarding-houses.	1869. Tenement-houses.	1869. Total Mortality.
11 days ending Jan. 11	106	155	392	653	9 days ending Jan. 9	76	71	299	446
" 18	108	92	241	441	" 16	56	101	252	409
" 25	88	74	282	444	" 23	85	112	256	453
Feb. 1	67	68	244	379	" 30	49	111	266	426
" 8	79	92	231	402	Feb. 6	94	119	248	461
" 15	91	110	247	448	" 13	72	123	242	437
" 22	79	125	244	448	" 20	104	97	248	449
" 29	88	74	275	437	" 27	86	117	251	454
Mar. 7	79	124	279	482	Mar. 6	77	139	228	444
" 14	89	202	173	464	" 13	79	152	246	477
" 21	77	113	222	412	" 20	72	152	269	493
" 28	89	144	247	480	" 27	102	159	222	483
April 4	83	108	272	463	April 3	64	165	258	487
" 11	84	147	241	472	" 10	64	150	221	435
" 18	116	139	254	509	" 17	83	161	231	475
" 25	93	103	239	435	" 24	52	132	236	420
May 2	86	117	250	453	May 1	73	184	220	477
" 9	95	112	225	432	" 8	102	221	178	501
" 16	76	122	242	440	" 15	101	181	234	516
" 23	79	94	234	407	" 22	79	145	225	449
" 30	71	123	214	408	" 29	76	148	226	450
June 6	76	76	196	348	June 5	97	92	227	416
" 13	81	98	213	392	" 12	87	133	205	425
" 20	87	86	214	387	" 19	91	168	235	494
" 27	104	101	222	427	" 26	70	156	237	463
July 4	84	53	276	413	July 3	92	161	291	544
" 11	96	137	381	614	" 10	120	182	340	642
" 18	119	259	764	1142	" 17	107	219	400	726
" 25	85	184	512	781	" 24	90	234	368	692
Aug. 1	81	159	490	730	" 31	78	201	352	631
" 8	107	183	461	751	Aug. 7	66	196	329	591
" 15	76	123	444	643	" 14	79	198	310	587
" 22	131	191	410	732	" 21	69	166	357	592
" 29	88	134	434	656	" 28	89	208	309	606
Sept. 5	96	139	364	599	Sept. 4	75	128	301	504
" 12	83	117	369	569	" 11	74	161	245	480
" 19	86	134	295	515	" 18	64	151	236	451
" 26	79	109	266	454	" 25	76	121	254	451
Oct. 3	112	100	260	472	Oct. 2	54	184	199	437
" 10	87	95	241	423	" 9	81	140	236	457
" 17	91	100	233	424	" 16	48	138	228	414
" 24	70	63	236	369	" 23	85	77	253	415
" 31	66	113	201	380	" 30	99	157	242	498
Nov. 7	50	87	199	336	Nov. 6	61	135	224	420
" 14	50	61	223	334	" 13	83	124	239	446
" 21	47	96	193	336	" 20	48	112	265	425
" 28	58	90	210	358	" 27	76	123	257	456
Dec. 5	52	97	201	350	Dec. 4	58	180	228	466
" 12	58	81	185	324	" 11	87	134	230	451
" 19	61	99	225	385	" 18	64	151	229	444
" 26	65	86	218	369	" 25	72	150	224	446
5 days ending December 31	65	136	166	367	6 days ending December 31	79	197	179	455
	4,314	6,025	14,550	24,889		4,065	7,817	13,285	25,167

Comparative Mortality in Tenement-Houses.—The above table, which shows the number of deaths in the public institutions, the number in private houses, hotels, boarding-houses, and other dwellings, the number in tenement-houses, and the total mortality of the city, week by week, for two years, is well worthy of careful attention. The mortality in the public institutions, if we except the few cases who come here from a distance every year for treatment in some of our first-class hospitals, is made up almost entirely of those who, but for those great charities, would die in tenement-houses. This fact is so patent to every observer that its details are of little service, although it would be gratifying if the registry of the dead could be carried back in every case to the houses which they left to enter the institution, and charged to the wards in which they actually belonged. The following statement shows the rate of mortality in each of the groups of houses above named:

In 1868 the percentage of deaths in the public institutions was 17.33; in 1869 it was 16.15, a gain of 1.18 per cent.

In 1868 the percentage of deaths in the private houses, hotels, boarding-houses, and other residences of New York—other than tenement-houses—was 24.21; in 1869 it was 31.06, a loss of 6.85 per centum.

In the former year the percentage of deaths in tenement-houses was 58.46; in the latter it was 52.79, a gain of 5.67 per centum.

Now, if we charge the mortality of the tenement-houses and the public institutions to the same general account in which, indeed, they actually belong, we find that the total tenement-house mortality in 1868 was 75.79 per centum of the whole; while in 1869 it was only 68.94, a gain of 6.85 per centum in favor of the latter year.

The following comparative table of the mortality in the tenement-houses, public institutions, and other dwellings in each of the three tenement-house districts, with the percentages on the mortality and population, shows very admirably, in statistical form, the facts that have just been stated:

MORTALITY.	1868.				1869.			
	First District.	Second District.	Third District.	Total.	First District.	Second District.	Third District.	Total.
In tenement-houses	3,645	5,823	5,082	14,550	3,359	5,192	4,734	13,285
In public institutions	338	91	3,885	4,314	311	90	3,664	4,065
In private dwellings	1,778	986	3,261	6,025	2,370	1,499	3,948	7,817
Total mortality	5,761	6,900	12,228	24,889	6,040	6,781	12,346	25,167
Percentage of deaths in tenement-houses	63.27	84.39	41.56	58.46	55.61	76.57	38.34	52.79
Percentage of deaths in public institutions	5.86	1.32	31.77	17.33	5.14	1.32	29.68	16.15
Percentage of deaths in private dwellings	30.86	14.29	26.67	24.21	39.25	22.11	31.98	31.06
Percentage of deaths in tenement-houses and public institutions on total mortality.	69.14	85.71	73.33	75.79	60.76	77.89	68.02	68.94
Percentage of deaths in tenement-houses and public institutions on total population	2.13	2.53	2.90	2.60	1.96	2.26	2.75	2.39
Percentage of total mortality on total population	3.08	2.96	4.00	3.43	3.22	2.91	4.04	3.46

It is believed that no more impressive statement of the fatal results of the forced companionship of families, which has grown to be the chief sanitary and social evil of the city, can be made than that given in the above paragraphs.

The gain during the present year is probably the most gratifying fact that can be found among the many statistical statements here presented. But it is still evident that there are fatal influences at work among the class of houses with which just now we have special concern, that are entirely unknown in other dwellings. And these evils, whether they are the result of the faults in their construction, of the habits of the people housed within them, of overcrowding, or of all these combined, it is quite clear that remedy is possible, even in the present state of our knowledge of the subject, and that the best interests of the city, pecuniary, physical, moral, or social, are somehow very intimately blended with the interests of those unhappy masses of humanity who are now compelled to live without domestic comfort, and to die in the very midst of an unfathomable social degradation.

Dens of Death.—The streets in which fatal results are most frequently found have already been noticed in detail. But in these streets there are certain houses which seem to merit the distinctive title that heads this paragraph—houses into which the sunlight never enters; houses wherein the inhabitants breathe, if they breathe at all, the poisonous exhalations of their own filth; houses through which neither the breath of summer nor the breeze of winter ever sweeps; houses that are dark, damp, and dismal, throughout all the days of the year, and for which it is no exaggeration to say that the money paid to the owners as rent is literally the "price of blood." In looking over the records of death against each particular house we find that there were three deaths each in 619 different houses; four deaths each in 239 houses; five deaths each in 115 houses; while in 84 houses the deaths during the year numbered six and upward. In No. 423 West Forty-first Street, one of the most cleanly of the very large tenement-houses of the city, there were thirteen deaths in a population of 317 persons, a death-rate of 4.10 per centum. No. 79 Baxter Street, front and rear, contains 25 families, or a total of 112 persons, of whom six died during the year, a percentage of 5.36 on the whole number of occupants. At No. 42 Henry Street, with a population of 138 persons, there were ten (10) deaths, or 7.24 per centum of the total population. In the "Old Baptist Church"—Nos. 5, 7, and 9 Mulberry—which has 360 occupants, there were 27 deaths, the percentage being 7.5. At No. 35 Baxter Street, a pair of dilapidated buildings, front and rear, occupied mainly by beggars and prostitutes, there is a population of 51 persons, among whom there were nine (9) deaths, which gives a death-rate equal to 17.5 per centum of the population, a mortality which is probably unequalled in any dwelling in the city. These are but a few illustrations of unwholesome housing which may be found in these records of tenement-house mortality, but they are sufficient to show the value of these registers in directing attention to those places wherein sanitary reform is most needed.

Overcrowding.—Two forms of overcrowding are prevalent, both of which are fatal. One pertains to the surface area, the other to the dwelling. In respect of both forms, New York has probably outpacked any of her metropolitan rivals. Dangerous as the art undoubtedly is, and fatal as these statistics clearly prove it to be, the practice of it does not seem to diminish in proportion to the increase of our knowledge of its results. A present gain is a much stronger motive than a prospective loss, and what seems a blessing now will not be put aside even in those cases where it is possible to demonstrate to the receiver that it will prove a curse in the future. To-day it is thrift to make these houses and acres produce cent-per-cent upon the investment, and the result of this pernicious greed of gain piles house upon house upon the acres, and family upon family into the houses, until both are made pestilential by the very load of humanity they are compelled to contain or carry: To-morrow every rood of land breathes forth contagion, every house becomes the dwelling-place of disease, and Death comes in to demand his thousands of lives as his share of these dearly-bought gains. This, however, is not and it cannot be made the economy and thrift under which cities grow great. The population must first be made healthy and vigorous; wealth, leisure, culture, may then speedily follow.

No better exhibit can be made of the dangerous manner in which New York crowds every available foot of her surface area than by contrasting some of the more densely-populated wards with an equal number of the more crowded districts of London. The following table presents a comparative view of this kind, by showing the rate of population to the acre in certain districts of these two metropolitan cities:

Table Showing the Area, Population, and Rate of Population to the Acre, of some of the more Densely-populated Districts of New York and London.

NEW YORK.				LONDON.			
Ward.	No. of Acres.	Population.	Rate to the acre	Name of District.	No. of Acres.	Population.	Rate to the acre
Fourth Ward..........	83	17,352	209	Whitechapel............	383	78,970	206
Sixth Ward............	86	19,754	230	St. Giles's................	245	54,076	221
Seventh Ward.........	110	36,962	187	St. James's, Westminster	164	35,326	215
Tenth Ward...........	198	31,537	287	East London............	153	40,687	266
Eleventh Ward.........	196	58,953	301	Strand....................	140	42,979	307
Thirteenth Ward.......	107	26,388	247	St. Luke's...............	220	57,073	259
Fourteenth Ward......	96	23,382	244	Holborn..................	196	44,862	229
Seventeenth Ward.....	331	79,563	241	West London...........	126	27,145	215
Totals and averages	1,207	293,891	243	Totals and averages..	1,627	381,118	234

The comparison is not favorable to New York. The Strand in London has a population more dense than any ward of this city, but even that only exceeds the density of the Eleventh Ward by six to the acre. The Sixth Ward of New York overtops St. Giles's of London by nine to the acre, and these two may be said to be the counterparts of each other in the poverty, the wretchedness, and the filth of their inhabitants. St. James's, Westminster, which is peopled by an entirely different class, is one of the lowest on the list we have given in London; while the Seventeenth Ward, which is the best of the wards of this city, selected for the purpose of comparison, has a population-density of twenty-six to the acre greater than the more fashionable and wealthy London district.

But the whole fact is not yet stated in regard to this species of overcrowding as it may be found in many parts of the city. Attention has already been called to some squares in the Second District where the population-density is nearly equal to one thousand to the acre. These overcrowded squares are not isolated; indeed, they are numerous, and are divided between the wards with an almost equal hand. Illustrations of the manner in which nearly every four or five square yards of surface-area is made to contain its inhabitant were given in the last Annual Report, and these conditions have not changed for the better since those paragraphs were written. As the matter now stands, in some portions of the Sixth, Fourteenth, Eleventh, Seventeenth, Eighteenth, and Twentieth Wards, the living have very little more ground-space than is appropriated to the dead—a distribution which is not less fatal than it is impartial.

The form of overcrowding which pertains to the dwelling is much the more deadly of the two. If the proximity of dwellings produces morbid mental and physical conditions, the proximity of families is still more demoralizing and pernicious. The forced companionship of the old and young of both sexes, which may be seen in almost any of the more crowded tenement-houses of each of the districts "is not nor it cannot come to good." Indeed, it does not seem possible to insist too strongly upon the sanitary and social results that inevitably follow those conditions which coerce families of five, six, or seven persons into two small rooms. It does not matter, in the last analysis, what these conditions are, so long as the fact is permitted. The want of accommodations for families arises from an increase of population without a corresponding increase in the number of dwelling-houses. This offers an inducement for the degradation of buildings that were intended and fitted but for a single family. Houses built for this purpose are let in floors; those intended to accommodate but one family on each floor are compelled to contain two; families who were once isolated find that they can save the rent by taking lodgers, and thus the process of agglomeration goes on until all the proprieties of life are violated, the pride of the family crushed, its sensibilities deadened, and the people so housed herd and huddle together in a manner that may be described as far more bestial than human. Poverty, scarcity of labor, the high prices of food-articles, together with that species of insanity which impels the poor to remain in the city when there is labor, self-help, comfort, competency, and health awaiting them in the fields just outside of it, are also causes of this species of overcrowding. But whatever the cause, whether any or all of these, or others that have not been named, the lack of domesticity and of privacy, which is the supreme vice of our tenement-house system, must be prejudicial, if not entirely fatal, to good order and good government.

The tenement-houses of New York have been much improved during the year by the enforcement of the provisions of the law in regard to drainage and ventilation. But these provisions need to be supplemented by an act which shall strike at the very root of the chief evil against which complaint is made, namely, *overcrowding*. There are many houses which are tenement-houses, under the definition of the law of 1867, against which no complaint can be made—houses that are let in floors to small families and so well kept and occupied as to be beyond the reach of such criticisms as are applied to houses that are manifestly overcrowded. It is in those dwellings wherein nearly every room is somebody's bedroom; wherein a pair with five or six children, with, possibly, two or three lodgers, occupy one-half the space that is devoted to a single family, without lodgers, in the class of houses just mentioned, that the evils of tenement-houses are to be found. In these cases overcrowding must be dealt with on the basis of its being technically a "nuisance." A certain amount of air-space must be insisted upon for each occupant of a room and bedroom before the evil will begin to yield to the operation of law. It is the exceedingly small proportion of cubic feet of air-space to the number of occupants that is the special vice of our tenement-houses, and this can be remedied only by more houses and a stricter enforcement of the sanitary laws regarding the size and ventilation of the space occupied. This proportion should be fixed by law, and the law should be enforced alike against house owners and occupants. Sanitary science has already determined the rate, *per capita*, at which fresh air must be admitted into dwelling-rooms to keep them pure and wholesome, and there seems to be no reason why the deductions of science should not be enacted into laws. In every instance where a family * occupies a given space, the amount of fresh air that is needed can be provided, by proper ventilation, in such quantities as will make the space healthful for the number of occupants, and the proportion may be stated in terms that are mathematically exact. And the notion seems to be fast becoming prevalent that, if healthy homes are to be had under any circumstances for the industrial and laboring classes, it is to this complexion that the law must come.

Untold benefits would also result from the compulsory sale of land for the purpose of making openings in those places where the surface-area is too much crowded. For this is an evil that has no other remedy. Under the operation of the existing Tenement-house Law, if it should hold its place upon the statute-book without change, and be rigidly enforced, the future is tolerably well provided for; but even the present provisions of the law are apt to be evaded, and have been in some cases where the cupidity of the property-owner overcame the legal obligation. In the older down-town districts, it cannot be expected that such openings will be made, except under a law which shall compel and pay for them. But the ventilation of a block is not less necessary than the ventilation of a house. Windows into dark bedrooms and openings through the roofs of buildings over the halls, beneficial as they undoubtedly are, wherever made, lose half their virtue when the ground-surface is so built upon that a free circulation of the air, front and rear, is impossible. The atmosphere should circulate as freely through a square as through a dwelling-house, if the dwelling-houses built upon the square are to be made into healthful homes.

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* In writing upon this subject an eminent hygienist has already expressed the following opinion: "I think it practically important that in the letter of the law no distinction should be drawn whether overcrowders are of one family or more. Otherwise technical difficulties become insuperable. For what is a 'family?' In one sense it means 'children with their parents,' but in another it may extend to an entire clan. It may fairly be left to magistrates (as a matter for discretion, according to local and peculiar circumstances,) to refrain from ordering the abatement of a given overcrowding if they see that it is of one family and could not be abated without hardship. Further, in my opinion, it is to be desired that laws and regulations as to overcrowding should not proceed on the assumption that children (to any measurable extent) require less breathing-space than adults. Against any such assumption two facts have to be considered: first, that even healthy children, in proportion to their respective bodily weights, are about twice as powerful as adults in deteriorating the air which they breathe; secondly, that the children will almost invariably have certain eruptive and other febrile disorders to pass through from which adult life is comparatively exempt, and in which the requirement of space is greatly increased. And having regard to these two considerations, I think it best that children and adults should be deemed to require equal allowances of air and ventilation."—*John Simon, Eighth Annual Report to the Privy Council, Blue Book, p. 15, note.*

The subject of overcrowding is presented in this manner, because the time does not seem to be distant when self-preservation acting as a motive will bring all classes together upon this plane, and require some legal enactment which shall have the effect of protecting all of them from those evils which now very plainly are the result of the overcrowded condition of the homes of the poor.

And this is one of the teachings of these statistics of the mortality of tenement-houses, namely, that overcrowding of the ground-space by dwellings, and overcrowding of dwellings by inhabitants, are the greatest social and sanitary evils against which the Metropolitan Board of Health has to make war. Other sanitary evils are limited in their operations, and affect but a few. They are local in their effects, and may be treated after the mode prescribed for merely local nuisances. These are general, and their effects are to be seen not only in the present, not only in the moral and social condition of those who live in this unnatural companionship, not only in the greatly-augmented death-rates of particular houses and blocks, but they reach far into the future, and jeopard the welfare of the city and the State to an extent which, soon or late, will demand and receive the interference of the legislative authorities.

Conclusion.—In the statistics presented herewith, and in the comments thereon, it has been the effort of the writer to present those facts that seemed most prominent in a manner commensurate with their sanitary and social importance. The subject is of vital interest; for the stability of the state, in the last analysis, depends upon the purity of the home. In many of the houses, whose vital statistics are the subject of this report, a home, in any thing like the original sense of the word, is an impossibility. "Home is the sacred refuge of our life;" but there is no such refuge in these crowded tenement-houses. The very instinct of domesticity, of privacy, of homelikeness, would be crushed in any one who would even make an effort to dwell in such untold filth and degradation. To children born and reared under such influences it is inevitable infamy. Life is too short to allow them to escape from the debauchery into which they are baptized at birth; and moral elevation, or an improved social standing, can rarely come to any family so environed and so housed.

The enormous mortality of tenement-houses is not the first, nor even the worst, of the evils their presence entails upon the city and the State. It is the unutterable negation of delicacy, and the mental and moral depreciation among the dwellers, rendering them an impediment rather than a help to the progress of civilization, that is most to be feared. But when those dwellings are improved in their sanitary condition, the dwellers are also improved in a social aspect, and the physical view of the hygienist becomes at last the spiritual view of the philanthropist. And, indeed, it is even now difficult to determine who will produce the better effect in the effort to elevate the overcrowded poor—the sanitary officer or the missionary. To achieve success, the efforts of both must go hand-in-hand; for, when we come to consider the subject of housing the poor hygienically, or in dealing with the social relations of such masses of humanity, neither of these aspects can be safely ignored.

Respectfully submitted:

Norris Randal Norton.

IS THE DEATH-RATE DECREASING IN THE TENEMENT-HOUSES?

The foregoing analysis of the records would seem to prove that the death-rate is decreasing. Certainly there is one kind of gain which is most encouraging; namely, death gained an entrance into fewer tenement-houses in the year 1869 than in the previous year; also, that the average of deaths to the tenements invaded by the destroyer was diminished slightly. And, for the present, we need venture upon no further conclusions. The records of structural improvements executed in tenement-houses the past two years warrant the belief that life is and will be more secure than it was in this class of dwellings.

THE CITY DEATH-RATE.

Mathematical accuracy should be given to every published record of death-rates. An accurate census and an ascertained rate of yearly increase of population are necessarily elements for the basis of such a statement of decimal ratios. In my reports to the Board in the preceding years, the sanitary and statistical demands for an accurate and well-ordered census have been stated.

In 1868, the common estimate of population was placed at 1,000,000 for New York, and 370,000 for Brooklyn. The yearly rate of increase by births and by immigration is supposed to be about six per centum upon the total. Brooklyn is believed to increase even more rapidly than at this rate. The time for the decennial census (1870) being at hand, I deem it sufficient that the death-rate for the year 1869, may be expressed upon the basis of 1,000,000 inhabitants in New York, and 370,000 in Brooklyn, as was done in the report for 1868. This would warrant the statement of the death-rate as being 25.13 per 1,000 inhabitants in the former city, and 22.59 in Brooklyn.

Though these are lower than the death-rates of Vienna, Berlin, Naples, and Liverpool; they are slightly higher than the death-rates in London and Paris. And as compared with the other commercial cities of the civilized world the death-rates in New York and Brooklyn compare very favorably. Yet the amount of mortality is fully 15 per centum too great; and it should be regarded as the duty of sanitary government and civic improvement to reduce the rate to an average of from 17 to 20 per 1,000 yearly. The fact must be borne in mind, however, that the death-rate in New York will have certain peculiarities that arise from the vast preponderance of the poor and ignorant classes, which comprise fully 65 per centum of the total population. And these classes not only live at a disadvantage in respect of their housing and domestic habits, but their crowded tenements swarm with children that suffer enormously from the fatal influence of such faultiness of home-life, while the excessive birth-rate in these classes apparently conforms to an excess in the waste of child-life, and to the degree of domestic and personal degradation. The infantine death rate is, from these circumstances, excessive throughout the tenement-house districts.

Death-rates in New York and Brooklyn, compared with those in other great cities, are below those in the chief cities of Europe, and are upon a par with the rates in the other maritime cities in the United States. Were the inhabitants of New York and Brooklyn accurately counted, the death-rate would be accurately stated at about 25 deaths in 1,000 inhabitants in New York, and 22 in 1,000 in Brooklyn.

The average death-rate in the fourteen chief cities and large towns in Great

Britain, in the year 1868, was precisely 25.68 per 1,000. London had a rate of only 23.59 per 1,000, while that of Glasgow was 30.47. The rate in Paris was about 24 per 1,000, while that of Berlin and Vienna was less than 30 in 1,000 only for a few weeks of the year. In all great cities the fluctuations in the death-rates depend largely upon the special fault and empoisonment of overcrowding and filth, on one hand, and the external sources of miasmatic disease on the other hand; and the fluctuations are excessive in proportion as the domestic and the civic sources of impurity are excessively abundant and active.

CONCLUSION.

In this and in each annual review of the Vital Statistics of New York and Brooklyn the past three years, the writer has endeavored to present the numerical records of life and of death in such a way as to aid the sanitary government, and also lay foundations for usefulness of such records in every successive year.

The pressure of daily duties in sanitary administration has not prevented the steady maintenance of the methods of exact inquiry and registration in this branch of labor under the Board of Health. The physical and the social conditions under which our fellow-beings live and die continue to be watched with profound interest; and, although in this duty much is seen that cannot now be wholly prevented or restrained from doing harm to human lives, a complete and constantly-revised record of the sources and the places of peril is now shown to be a practicable acquisition by a Board of Health. In these four successive years the chief object in our daily and yearly reviews of the death-rolls has been to find out the facts by which the health laws could be guided to most useful applications. And, in thus contributing to the establishment of a correct basis for the administration of sanitary duties, the records of mortality and of the circumstances attending the preventable and avoidable kinds of disease are found to have an important share in practically working out the problems of public hygiene. In these records, and the sanitary inquiries connected with them during the four successive years, every authenticated fact concerning the causes of death has been freely given to the public by the Board of Health; and, without mentioning the increase of population, the total mortality in each age of the decedents, by each cause of death, and in the several wards, and streets, and institutions of the city, has been published in full, and in such manner as to compare these yearly records with each other, and with the unattained standards which should be reached. Sanitary officers owe this kind of duty to the people, for every inhabitant has a right to know what causes of death are receiving the attention of those officers, and to be informed, also, what avoidable causes of death demand individual care.

The two great groups of causes, namely, the *avoidable*, or *preventable*, and the *inevitable*, which bring all human lives to the

> "last scene of all,
> That ends this strange eventful history,"

must continue to receive the studious attention of sanitary authorities; and, as the popular knowledge of sanitary duties, the general increase in the means of healthy living, and the recognition of obligation to preserve the public health, increase, it will be found that much that is now counted as *inevitable* among the causes that war against the lives of our fellow-beings will disappear, and the average value of a human life become thereby greatly increased. It still will be inevitable that the normal and healthful mechanism of the human body will wear out in old age; that the urgent pressure of life's duties and anxieties, and particularly that by the abuse of appetites and passions, the functions of the body may become impaired and fatally crippled; that perils and casualties will continue to be incurred in the pursuance of daily duty; and that, for the benefit of others, or from necessary exigencies, individuals will be temporarily exposed to dangerous miasmata and contagia; nevertheless the aggregate of the inevitable causes of premature disease and mortality steadily decreases under the influence of sanitary instruction and the interventions of health laws. Much that was inevitable, and much that is at present counted as unavoidable, will become preventable. The most useful duties of sanitary officers are not all coercive in their operation, for there are evils that can be overcome only by the increased and general diffusion of knowledge concerning the natural laws of health. The child, the man, and the family, and the teachers of youth, should be made practically familiar with the truths of physiology and the natural things which affect health. Cities and States also will yet prove that, by their provision and administration of sanitary regulations and works for promoting the public health, the highest objects of State and municipal economy and social progress are served. But such views of public duty and the resulting benefits to society cannot be realized except by a wide diffusion of the knowledge of the means of healthy living. Epidemics and pestilences may be restrained and much life saved by the authoritative interventions of health laws, but no amount of legislation can extirpate all the ills that flesh is heir to. And, as has been well said by one of the ablest teachers of hygiene, "The last disease will disappear, we may believe, only when man is perfect; and as in the presence of the Saviour all disease was healed, so, before perfect virtue, sorrow and suffering shall fade away. Yet, in the midst of all our many errors, we are certainly gaining knowledge, and that knowledge tells us in no doubtful terms that the fate of man is in his own hands."

E. Harris, M. D.,
Sanitary Superintendent.

APPENDED STATEMENT NO. I.

METEOROLOGICAL OBSERVATIONS, BY WEEKS, FOR THE TWELVE MONTHS ENDING DECEMBER 31, 1869.

Condensed from Daily Observations of Professor Oran W. Morris, Observer in New York for the Smithsonian Institute.

Contributed Weekly to the Metropolitan Board of Health.

DATE. WEEK ENDING—	Mean temperature (Fahrenheit scale).	Greatest range of temperature in the week.	Average humidity—saturation being 100°.	Total rainfall. (Inches of water.)	Mean pressure of the atmosphere.	Prevalent winds.	REMARKS CONCERNING THE GENERAL ASPECTS OF THE WEATHER.
Nine days ending January 9, 1869.	32.27	15.54	71.71	2.07	29.79	W.	Rain on 4 days; rain and snow on 1 day.
January 16, 1869...	35.14	19.53	77.50	.89	29.81	N. W.	Rain on 2 days; rain and snow on 1 day.
" 23, " ...	29.00	12.42	70.	.62	29.92	N. E.	Solar halo, 17th; parhelion, 23d; snow, 17th, 18th, 19th.
" 30, " ...	32.43	8.55	63.	.60	29.72	W.	Lunar corona, 25th; solar halo, 26th; lunar eclipse, 27th. Rain on 2 days.
Av. for the month..	32.21	8.55	70.55	4.18	29.81		*These four weeks were mild, but stormy.*
February 6, 1869...	24.28	15.41	56.	1.63	29.70	N. W.	Snow on 1 day; sleet on 1 day.
" 13, " ...	39.71	20.70	72.	.62	29.94	E.	Snow on the 9th and 10th.
" 20, " ...	35.71	20.45	36.	3.41	29.52	W.	Rain, 17th; snow, 18th, 19th, and 20th.
" 27, " ...	32.14	17.50	71.	1.63	29.73	N. E.	Snow, 24th, 26th, and 27th; solar halo on the 25th.
Av. for the month..	32.96	15.70	58.75	7.29	29.72		*An uncommonly mild month, but snow on one-third of the month.*
March 6, 1869......	23.00	2.42	70.	.64	29.81	N. W.	Snow on 2d, 4th, and 6th.
" 13, "	34.57	15.53	65.	1.22	29.85	W.	Snow on 12th; aurora borealis, 9th.
" 20, "	32.57	19.51	69.	.64	29.85	W.	Snow, 14th, 15th, and 19th; zodiacal light 3 times.
" 27, "	38.71	15.66	72.	2.02	30.00	W.	Snow, 23d; rain, 26th and 27th.
Av. for the month..	28.85	2.66	79.	4.52	29.87		*The four weeks of March were colder than either of the preceding months, and snow fell every week.*
April 3, 1869.......	56.00	32.76	79.	1.74	29.56	E.	Rain, 29th, 30th, and 1st.
" 10, "	43.00	26.57	59.	.28	29.64	W.	Snow, 4th and 7th; solar halo, 5th; thunder-shower 7th; aurora borealis, 9th.
" 17, "	46.59	40.53	32.	.14	29.82	N.	Snow, 13th and 14th; rain, 17th; solar halo, 11th; aurora borealis, 14th and 15th.
" 24, "	60.85	45.78	61.	.36	29.69	W.	Rain, 20th and 21st; solar halo, 24th.
Av. for the month..	51.61	26.78	57.75	2.52	29.68		*The four weeks of April were about of the usual temperature; a very little rain fell. In this month the first thunder-shower of the season occurred.*
May 1, 1869........	54.85	35.76	67.	.37	29.67	E.	Lightning, 27th; rain, 29th, 30th, and 1st.
" 8, "	49.14	37.65	84.	1.48	29.62	W.	Rain on 4 days; thunder-shower, 2d; snow, 2d.
" 15, "	64.50	52.80	69.	.43	29.55	E.	Thunder-showers, 13th and 15th.
" 22, "	55.00	50.58	54.	2.98	29.58	W.	Thunder-shower, 16th; hail, 16th; meteor, 20th. Rain on 6 days.
" 29, "	62.64	53.73	56.	.48	29.77	N. W.	Rain on 4 days; thunder-showers, 26th and 28th; rainbow, 26th; lunar corona, 28th.
Av. for the month..	57.23	35.80	66.	5.74	29.64		*The five weeks of May have been very pleasant. Not a great quantity of rain fell.*
June 5, 1869.......	68.53	61.75	60.	.79	29.80	E.	Thunder-showers, 31st and 5th; rainbow, 5th.
" 12, "	59.35	53.62	54.	.56	29.89	W.	Aurora borealis, 6th; thunder-shower and hail, 8th. Rain on 4 days.
" 19, "	70.95	60.83	56.	.99	29.70	W.	Rain on 2 days.
" 26, "	71.52	61.75	68.	1.60	29.76	S.	Rain on 5 days; thunder-shower, 22d.
Av. for the month..	67.59	53.83	59.50	3.94	29.79		*The four weeks in June have been of the usual temperature, but with a large proportion of wet days.*

Meteorological Observations, by Weeks—(Continued).

DATE. WEEK ENDING—	Mean temperature (Fahrenheit scale).	Greatest range of temperature in the week.	Average humidity—saturation being 100°.	Total rain-fall. (Inches of water.)	Mean pressure of the atmosphere.	Prevalent winds.	REMARKS CONCERNING THE GENERAL ASPECTS OF THE WEATHER.
July 3, 1869........	74.42	64.78	69.	1.55	29.76	S. W.	Rain on 5 days; thunder-showers, 27th, 28th, and 3d; rainbow, 28th; lightning, 29th.
" 10, "	70.53	65.79	64.	.53	29.86	S.	Thunder-shower, 9th.
" 17, "	76.27	67.82	62.33	1.93	29.78	W.	Thunder-showers, 15th and 16th; rain on 4 days.
" 24, "	72.45	70.75	62.69	.70	29.80	W.	Thunder-shower, 21st; meteor, 20th; lunar corona, 19th.
" 31, "	75.15	72.77	64.85	.87	29.88	W.	Thunder-showers, 27th and 29th; lightning, 29th; rain 2 days.
Av. for the month..	73.76	64.82	64.57	5.58	29.82		*The five weeks in July were very pleasant, with the usual quantity of rain. Nine thunder-showers occurred.*
August 7, 1869.....	71.14	62.82	58.96	.37	29.89	W.	Thunder-shower, 5th; rain on 1 day.
" 14, "	73.59	64.82	55.65	.62	29.94	S.	Thunder-shower, 13th.
" 21, "	76.81	63.93	68.47	.72	29.83	S. W.	Thunder-shower, 15th; meteor, 16th: rain on 3 days.
" 28, "	74.15	67.82	62.28	....	29.94	S.	Meteor, 24th; lightning, 28th.
Av. for the month..	73.92	62.93	61.34	1.71	29.90		*The four weeks of August were warm and dry.*
September 4, 1869..	66.11	56.81	54.41	.14	29.94	N. W.	Aurora borealis, 2d and 3d; rain 1 day.
" 11, " ..	71.55	58.81	60.04	.42	29.84	S. E.	Aurora borealis, 9th and 11th; rain on 3 dys.
" 18, " ..	69.15	61.76	65.50	1.26	30.12	S. E.	Aurora borealis, 13th, 14th, and 15th; lunar corona, 16th; rain on 2 days.
" 25, " ..	70.66	62.85	70.21	.62	30.12	E.	Lightning, 20th; rain on 2 days.
Av. for the month..	69.37	56.85	62.54	2.44	30.00		*These four weeks were warm and dry, with uncommon displays of aurora borealis.*
October 2, 1869....	61.23	48.74	58.89	2.90	30.02	W.	Aurora borealis, 27th and 28th; rain on 2 days.
" 9, "	60.00	49.69	74.94	3.98	29.87	W.	Aurora borealis, 6th and 7th; rain on 3 days.
" 16, "	55.00	44.69	70.13	4.10	29.68	N. W.	Lightning, 12th; lunar rainbow, 16th; rain on 6 days.
" 23, "	48.00	33.61	68.42	1.50	29.77	S. W.	Lunar halo, 19th; rain on 3 days.
" 30, "	41.81	34.52	50.27	.10	29.86	N. W.	Aurora borealis, 12th; rain on 2 days.
Av. for the month..	53.21	33.74	64.73	11.08	29.84		*The five weeks of October were more than usually cool and rainy, with displays of aurora borealis and the lunar rainbow.*
November 6, 1869..	44.42	31.58	59.19	.02	29.90	W.	Solar halo, 1st; snow and meteors on 1st; rain on 1 day.
" 13, " ..	37.27	32.44	51.38	....	29.70	W.	Snow, 13th and 7th.
" 20, " ..	42.19	32.58	63.00	2.22	29.72	W.	Snow, 14th and 16th; aurora borealis and lunar corona on 15th; rain on 3 days.
" 27, " ..	37.38	26.48	60.52	.94	29.94	W.	Snow, 24th; rain on 2 days.
Av. for the month..	40.32	26.58	58.52	3.18	29.82		*The four weeks of November were also quite cool, with much snowy weather.*
December 4, 1869..	36.92	18.55	58.77	.30	29.92	N. W.	Snow, 2d, 3d, and 4th; rain on 2 days.
" 11, " ..	29.99	16.45	61.07	1.41	30.11	N. W.	Snow, 6th; sleet, 5th; lunar corona, 10th.
" 18, " ..	36.45	23.45	68.27	1.38	29.97	N. E.	Sleet, 18th; aurora borealis and meteor, 18th; lunar corona, 16th; rain 2 days.
" 25, " ..	33.97	25.54	67.84	1.01	30.11	W.	Snow, 20th and 21st; aurora borealis, 19th; solar halo, 25th.
Six days ending December 31, 1869...	41.07	34.48	77.23	1.89	29.81	W.	Rain on 2 days.
Av. for the month..	35.68	16.55	66.64	5.99	29.98		*These five weeks had a moderate temperature, and very little stormy weather.*
Mean for 1869......	51.50	2.93	63.49	59.67	29.82		*Rain fell on 108 days; snow fell on 36 days; aurora borealis was observed on 20 nights.*

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METEOROLOGICAL OBSERVATIONS, BY WEEKS, FOR THE TWELVE MONTHS ENDING DECEMBER 31, 1869.

Condensed from Daily Observations of Professor Oran W. Morris, Observer in New York for the Smithsonian Institute.

Contributed Weekly to the Metropolitan Board of Health.

DATE. WEEK ENDING—	Mean temperature (Fahrenheit scale).	Greatest range of temperature in the week.	Average humidity—saturation being 100°.	Total rainfall. (Inches of water.)	Mean pressure of the atmosphere.	Prevalent winds.	REMARKS CONCERNING THE GENERAL ASPECTS OF THE WEATHER.
Nine days ending January 9, 1869.	32.27	15.54	71.71	2.07	29.79	W.	Rain on 4 days; rain and snow on 1 day.
January 16, 1869...	35.14	19.53	77.50	.89	29.81	N. W.	Rain on 2 days; rain and snow on 1 day.
" 23, " ...	29.00	12.42	70.	.62	29.92	N. E.	Solar halo, 17th; parhelion, 23d; snow, 17th, 18th, 19th.
" 30, " ...	32.43	8.55	63.	.60	29.72	W.	Lunar corona, 25th; solar halo, 26th; lunar eclipse, 27th. Rain on 2 days.
Av. for the month..	32.21	8.55	70.55	4.18	29.81		*These four weeks were mild, but stormy.*
February 6, 1869...	24.28	15.41	56.	1.63	29.70	N. W.	Snow on 1 day; sleet on 1 day.
" 13, " ...	39.71	20.70	72.	.62	29.94	E.	Snow on the 9th and 10th.
" 20, " ...	35.71	20.45	36.	3.41	29.52	W.	Rain, 17th; snow, 18th, 19th, and 20th.
" 27, " ...	32.14	17.50	71.	1.63	29.73	N. E.	Snow, 24th, 26th, and 27th; solar halo on the 25th.
Av. for the month..	32.96	15.70	58.75	7.29	29.72		*An uncommonly mild month, but snow on one-third of the month.*
March 6, 1869......	23.00	2.42	70.	.64	29.81	N. W.	Snow on 2d, 4th, and 6th.
" 13, "	34.57	15.53	65.	1.22	29.85	W.	Snow on 12th; aurora borealis, 9th.
" 20, "	32.57	19.51	69.	.64	29.85	W.	Snow, 14th, 15th, and 19th; zodiacal light 3 times.
" 27, "	38.71	15.66	72.	2.02	30.00	W.	Snow, 23d; rain, 26th and 27th.
Av. for the month..	28.85	2.66	79.	4.52	29.87		*The four weeks of March were colder than either of the preceding months, and snow fell every week.*
April 3, 1869.......	56.00	32.76	79.	1.74	29.56	E.	Rain, 29th, 30th, and 1st.
" 10, "	43.00	26.57	59.	.28	29.64	W.	Snow, 4th and 7th; solar halo, 5th; thunder-shower 7th; aurora borealis, 9th.
" 17, "	46.59	40.53	32.	.14	29.82	N.	Snow, 13th and 14th; rain, 17th; solar halo, 11th; aurora borealis, 14th and 15th.
" 24, "	60.85	45.78	61.	.36	29.69	W.	Rain, 20th and 21st; solar halo, 24th.
Av. for the month..	51.61	26.78	57.75	2.52	29.68		*The four weeks of April were about of the usual temperature; a very little rain fell. In this month the first thunder-shower of the season occurred.*
May 1, 1869........	54.85	35.76	67.	.37	29.67	E.	Lightning, 27th; rain, 29th, 30th, and 1st.
" 8, "	49.14	37.65	84.	1.48	29.62	W.	Rain on 4 days; thunder-shower, 2d; snow, 2d.
" 15, "	64.50	52.80	69.	.43	29.55	E.	Thunder-showers, 13th and 15th.
" 22, "	55.00	50.58	54.	2.98	29.58	W.	Thunder-shower, 16th; hail, 16th; meteor, 20th. Rain on 6 days.
" 29, "	62.64	53.73	56.	.48	29.77	N. W.	Rain on 4 days; thunder-showers, 26th and 28th; rainbow, 26th; lunar corona, 28th.
Av. for the month..	57.23	35.80	66.	5.74	29.64		*The five weeks of May have been very pleasant. Not a great quantity of rain fell.*
June 5, 1869.......	68.53	61.75	60.	.79	29.80	E.	Thunder-showers, 31st and 5th; rainbow, 5th.
" 12, "	59.35	53.62	54.	.56	29.89	W.	Aurora borealis, 6th; thunder-shower and hail, 8th. Rain on 4 days.
" 19, "	70.95	60.83	56.	.99	29.70	W.	Rain on 2 days.
" 26, "	71.52	61.75	68.	1.60	29.76	S.	Rain on 5 days; thunder-shower, 22d.
Av. for the month..	67.59	53.83	59.50	3.94	29.79		*The four weeks in June have been of the usual temperature, but with a large proportion of wet days.*

Meteorological Observations, by Weeks—(Continued).

DATE.	Mean temperature (Fahrenheit scale).	Greatest range of temperature in the week.	Average humidity—saturation being 100°.	Total rain-fall. (Inches of water.)	Mean pressure of the atmosphere.	Prevalent winds.	REMARKS CONCERNING THE GENERAL ASPECTS OF THE WEATHER.
WEEK ENDING—							
July 3, 1869........	74.42	64.78	69.	1.55	29.76	S. W.	Rain on 5 days; thunder-showers, 27th, 28th, and 3d; rainbow, 28th; lightning, 29th.
" 10, "	70.53	65.79	64.	.53	29.86	S.	Thunder-shower, 9th.
" 17, "	76.27	67.82	62.33	1.93	29.78	W.	Thunder-showers, 15th and 16th; rain on 4 days.
" 24, "	72.45	70.75	62.69	.70	29.80	W.	Thunder-shower, 21st; meteor,20th; lunar corona, 19th.
" 31, "	75.15	72.77	64.85	.87	29.88	W.	Thunder-showers, 27th and 29th; lightning, 29th; rain 2 days.
Av. for the month..	73.76	64.82	64.57	5.58	29.82		*The five weeks in July were very pleasant, with the usual quantity of rain. Nine thunder-showers occurred.*
August 7, 1869.....	71.14	62.82	58.96	.37	29.89	W.	Thunder-shower, 5th; rain on 1 day.
" 14, "	73.59	64.82	55.65	.62	29.94	S.	Thunder-shower, 13th.
" 21, "	76.81	63.93	68.47	.72	29.83	S. W.	Thunder-shower, 15th; meteor, 16th: rain on 3 days.
" 28, "	74.15	67.82	62.28	....	29.94	S.	Meteor, 24th; lightning, 28th.
Av. for the month..	73.92	62.93	61.34	1.71	29.90		*The four weeks of August were warm and dry.*
September 4, 1869..	66.11	56.81	54.41	.14	29.94	N. W.	Aurora borealis, 2d and 3d; rain 1 day.
" 11, " ..	71.55	58.81	60.04	.42	29.84	S. E.	Aurora borealis, 9th and 11th; rain on 3 dys.
" 18, " ..	69.15	61.76	65.50	1.26	30.12	S. E.	Aurora borealis, 13th, 14th, and 15th; lunar corona, 16th; rain on 2 days.
" 25, " ..	70.66	62.85	70.21	.62	30.12	E.	Lightning, 20th; rain on 2 days.
Av. for the month..	69.37	56.85	62.54	2.44	30.00		*These four weeks were warm and dry, with uncommon displays of aurora borealis.*
October 2, 1869....	61.23	48.74	58.89	2.90	30.02	W.	Aurora borealis, 27th and 28th; rain on 2 days.
" 9, "	60.00	49.69	74.94	3.98	29.87	W.	Aurora borealis, 6th and 7th; rain on 3 days.
" 16, "	55.00	44.69	70.13	4.10	29.68	N. W.	Lightning, 12th; lunar rainbow, 16th; rain on 6 days.
" 23, "	48.00	33.61	68.42	1.50	29.77	S. W.	Lunar halo, 19th; rain on 3 days.
" 30, "	41.81	34.52	50.27	.10	29.86	N. W.	Aurora borealis, 12th; rain on 2 days.
Av. for the month..	53.21	33.74	64.73	11.08	29.84		*The five weeks of October were more than usually cool and rainy, with displays of aurora borealis and the lunar rainbow.*
November 6, 1869..	44.42	31.58	59.19	.02	29.90	W.	Solar halo, 1st; snow and meteors on 1st; rain on 1 day.
" 13, " ..	37.27	32.44	51.38	....	29.70	W.	Snow, 13th and 7th.
" 20, " ..	42.19	32.58	63.00	2.22	29.72	W.	Snow, 14th and 16th; aurora borealis and lunar corona on 15th; rain on 3 days.
" 27, " ..	37.38	26.48	60.52	.94	29.94	W.	Snow, 24th; rain on 2 days.
Av. for the month..	40.32	26.58	58.52	3.18	29.82		*The four weeks of November were also quite cool, with much snowy weather.*
December 4, 1869..	36.92	18.55	58.77	.30	29.92	N. W.	Snow, 2d, 3d, and 4th; rain on 2 days.
" 11, " ..	29.99	16.45	61.07	1.41	30.11	N. W.	Snow, 6th; sleet, 5th; lunar corona, 10th.
" 18, " ..	36.45	23.45	68.27	1.38	29.97	N. E.	Sleet, 18th; aurora borealis and meteor, 18th; lunar corona, 16th; rain 2 days.
" 25, " ..	33.97	25.54	67.84	1.01	30.11	W.	Snow, 20th and 21st; aurora borealis, 19th; solar halo, 25th.
Six days ending December 31, 1869...	41.07	34.48	77.23	1.89	29.81	W.	Rain on 2 days.
Av. for the month..	35.68	16.55	66.64	5.99	29.98		*These five weeks had a moderate temperature, and very little stormy weather.*
Mean for 1869......	51.50	2.93	63.49	59.67	29.82		*Rain fell on 108 days; snow fell on 36 days; aurora borealis was observed on 20 nights.*

APPENDED STATEMENT No. III.

Return of Interments in different Cemeteries for the City and County of New York, during the Year ending December 31, 1869.

Total number of Interments.	Calvary.	Greenwood.	City.	Lutheran.	Outside of Metropolitan District.	Trinity.	Cypress Hills.	Evergreens.	Union.	New York Bay.	Flatbush.	Westchester.	Marble.	Woodlawn.	St. Mark's.	Mt. Olivet, Machpelah, Washington, and interments in various other burial-places within Metropolitan District.
25,167	9,612	2,975	3,162	2,932	1,383	249	1,628	1,104	580	301	198	125	100	183	35	600

APPENDED STATEMENT No. IV.

BIRTHS IN THE CITY OF BROOKLYN IN THE YEAR ENDING SEPTEMBER 30, 1869.

MONTHS.	TOTAL BIRTHS.	COLOR.		SEX.		NATIVITY.				
		White.	Black.	Male.	Female.	Foreign.	Native.	Foreign Father only.	Foreign Mother only.	Not stated.
October, 1868	437	432	5	256	181	166	161	56	53	1
November, "	455	451	4	253	202	186	153	60	50	6
December, "	424	416	8	216	208	165	183	48	24	4
Total	1,316	1,299	17	725	591	517	497	164	127	11
January, 1869	440	431	9	232	208	199	161	42	36	2
February, "	422	415	7	208	214	209	146	31	35	1
March, "	415	409	6	221	194	184	154	40	35	2
Total	1,277	1,255	22	661	616	592	461	113	106	5
April, 1869	298	293	5	155	143	137	103	33	24	1
May, "	376	372	4	189	187	135	136	52	51	2
June, "	441	439	2	240	201	182	173	50	26	10
Total	1,115	1,104	11	584	531	454	412	135	101	13
July, 1869	432	430	2	212	220	201	150	47	32	2
August, "	503	500	3	290	213	213	175	63	51	1
September, "	495	492	3	271	224	223	189	42	37	4
Total	1,430	1,422	8	773	657	637	514	152	120	7

Appended Statement No. IV.—(Continued).

REPORT OF MARRIAGES IN THE CITY OF BROOKLYN AND COUNTY OF KINGS, FOR THE YEAR ENDING SEPTEMBER 30, 1869.

MONTHS.	TOTAL.	COLOR.		NATIVITY.						CONDITION.					
				FOREIGN.		NATIVE.		NOT STATED.		SINGLE.		MARRIED.		NOT STATED.	
		Black.	White.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.
October, 1868	424	8	416	95	83	116	126	1	3	154	151	25	25	33	36
November, "	518	2	516	123	112	130	140	6	7	188	179	26	31	45	49
December, "	408	....	408	95	81	107	122	2	1	138	133	32	26	34	45
Total	1,350	10	1,340	313	276	353	388	9	11	480	463	83	82	112	130
January, 1869	322	2	320	93	89	65	69	3	3	107	115	26	19	28	27
February, "	326	10	316	77	72	77	82	9	9	114	113	17	18	32	32
March, "	302	10	292	73	65	76	85	2	1	112	110	23	24	16	17
Total	950	22	928	243	226	218	236	14	13	333	338	66	61	76	76
April, 1869	408	6	402	107	104	96	99	1	1	143	148	36	28	25	28
May, "	530	4	526	148	133	109	124	8	8	190	192	39	34	36	39
June, "	442	2	440	112	108	106	110	3	3	163	165	29	26	29	30
Total	1,380	12	1,368	367	345	311	333	12	12	496	505	104	88	90	97
July, 1869	316	8	308	91	89	64	54	3	15	103	109	27	19	28	30
August, "	310	4	306	89	90	62	53	4	12	98	106	25	26	32	23
September, "	546	4	542	123	128	128	113	22	32	130	143	99	113	44	17
Total	1,172	16	1,156	303	307	254	220	29	59	331	358	151	158	104	70

Report of Marriages in the City of Brooklyn and County oj Kings—(Continued).

MONTHS.	AGE.																							
	Under 20 years.		20-25.		25-30.		30-35.		35-40.		40-45.		45-50.		50-55.		55-60.		60-65.		65-70.		Not stated.	
	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.
October, 1868	....	47	71	92	77	44	21	17	20	5	13	2	6	3	3	1	..	..	1	..	..	..	..	1
November, "	6	67	90	94	82	60	36	19	17	7	14	2	5	..	1	..	2	1	1	1	1	..	4	8
December, "	4	43	71	96	66	29	21	17	21	9	6	3	4	1	3	2	5	1	..	..	1	..	2	3
Total	10	157	232	282	225	133	78	53	58	21	33	7	15	4	7	3	7	2	2	1	2	..	6	12
January, 1869	6	32	43	62	53	37	28	15	12	9	11	1	4	2	1	..	2	1	..	..	..	..	1	2
February, "	3	34	55	59	49	36	19	8	14	8	5	4	4	2	3	1	1	..	1	2	1	..	8	9
March, "	4	40	56	61	47	23	18	14	6	7	9	4	4	..	3	1	2	..	1	..	..	..	1	1
Total	13	106	154	182	149	96	65	37	32	24	25	9	12	4	7	2	5	1	2	2	1	..	10	12
April, 1869	5	40	67	86	64	39	26	15	17	15	13	2	6	3	..	..	2	1	1	1	1	..	2	2
May, "	5	62	88	106	94	49	27	17	24	9	8	10	10	5	5	3	1	..	..	..	..	..	3	4
June, "	6	57	88	99	64	32	26	19	17	7	10	3	4	1	2	2	..	..	1	..	1	..	2	1
Total	16	159	243	291	222	120	79	51	58	31	31	15	20	9	7	5	3	1	2	1	2	..	7	7
July, 1869	5	29	41	54	48	42	26	9	10	8	10	10	1	4	6	1	3	4	..	1	..	..	3	1
August, "	3	24	39	61	45	36	26	10	9	6	6	11	6	9	4	2	2	4	1	1	1	1	1	2
September, "	6	70	89	91	81	59	36	16	7	13	16	9	10	13	6	4	3	3	3	1	6	..	1	3
Total	14	123	169	206	174	137	88	35	26	27	32	30	17	26	16	7	8	11	4	3	7	1	5	6

APPENDED STATEMENT NO. V.

VITAL STATISTICS OF HOSPITALS AND OTHER BENEVOLENT INSTITUTIONS OF THE CITY AND COUNTY OF NEW YORK, as Reported December 31, 1869.

NAME OF INSTITUTION.	Present capacity. Number of Beds.	Total admissions in the year.	Total number of cases that received care in the Institution.	NATIVE-BORN.		FOREIGN-BORN.		DEATHS.					Death-rate per 1,000.	Percentage of Mortality on total.	REMARKS.
				Males.	Females.	Males.	Females.	Native Males.	Native Females.	Foreign Males.	Foreign Females.	Total Deaths.			
Hospitals:															
New York Hospital	162	1,416	1,644	631		903		....	....	.....	....	137	83.94	8.39	
Bellevue Hospital	850	6,481	7,174	1,201	795	2,511	1,974	161	100	396	242	899	125.31	12.53	A city institution for the sick and diseased poor of all ages and conditions. Incurables, and those afflicted with contagious diseases, not admitted. Located, 27th Street and East River. Application made at No. 66 Third Avenue.
St. Luke's Hospital	200	828	949	366		583		....	....	.....	....	133	140.14	14.01	The annual report of the Hospital, for which statistics are made up, is from St. Luke's Day (October 18), 1868, to St. Luke's Day, 1869. This institution is not altogether a charitable one; yet, indigent persons, of respectable character, are often admitted free. Admits persons of all denominations. Terms, $6 per week. Located in 54th Street, between Fourth and Fifth Avenues.
St. Vincent's Hospital	150	785	847	65	43	389	350	12	5	47	35	99	116.87	11.68	Admits persons of all ages and conditions. Terms, $4 to $5 per week. Sometimes admitted free. Application made at the Hospital. In charge of the Sisters of Charity. Located in 11th Street and Seventh Avenue. Established 1849. The report dates from October 1, 1868, to October 1, 1869.
Mount Sinai Hospital	81	684	1,590	37	20	408	219	5	2	23	17	47	29.55	2.95	Admits members of the Jewish faith of both sexes. Destitute persons admitted free. Outdoor poor also treated free. In cases of accident, all persuasions admitted. No. 138 West 28th Street.
Women's Hospital	.....	.....	....	.....	.....	.....	.....	....	....	.....	....	.....	......	......	
St. Franciscus Hospital	90	727	793	16	8	605	164	3	....	36	24	63	79.47	7.94	Managed by the "Sisters of the Poor of St. Francis." Located at 407 & 409 5th Street and 173 6th Street.

German Hospital and Dispensary	100	189	189	8	1	135	45	1	1	10	2	14	74.07	7.40	The German Hospital and Dispensary is an institution entirely new, and was opened September 14, 1869; founded on public contributions. Located at the southeast corner of Fourth Avenue and 77th Street. Report from September 14, 1869, to December 31, 1869 (inclusive).
Bloomingdale Lunatic Asylum...	175	147	304	48	58	17	24	14	8	1	4	27	88.80	8.88	This institution is about to be removed to White Plains, where an extensive farm has been purchased by the Governors of the New York Hospital.
Nursery and Child's Hospital....	......	......	......	......	......	......	......	....	....	.....	....	.....	......	......	
New York Infirmary for Women and Children..................	12	116	116	28	74	......	70	....	2	.....	....	2	17.24	1.72	Located at 126 Second Avenue.
Asylum for Lying-in Women.....	24	79	79	......	16	......	63	....	....	.....	....	.....	......	......	Admits respectable poor women, during the period of confinement, without charge. Located at 85 Marion Street.
Eye and Ear Infirmary...........	68	8,597	8,597	2,116	1,829	2,827	1,825	....	2	2	....	4	0.41	0.04	Poor persons are treated, free, for the eyes, daily, at 12 o'clock, and for the ear, Tuesdays, Thursdays, and Saturdays, at 2 o'clock, by experienced and scientific operators. Medicines are also given free. Located in Second Avenue, corner of 13th Street. Founded 1820.
Hospitals and other Institutions on Blackwell's Island;															
Alms-House.......................	1,170	2,979	4,053	214	241	1,843	1,755	....	3	15	3	21	5.18	0.51	Application daily, at No. 66 Third Avenue.
Penitentiary.......................	786	1,563	2,065	861	112	784	308	*2	4	1	....	7	3.38	0.33	* This includes one transferred to Fever Hospital, where he died. Apply at No. 66 Third Avenue.
Charity Hospital.................	920	6,191	7,020	1,573		4,618		117		425		542	60.74	6.07	The sex of native and foreign-born not classified. Apply to No. 66 Third Avenue.
Small-pox Hospital..............	105	662	668	151		511		14		38		52	77.84	7.78	The sex of native and foreign-born not classified. A city institution, for the poor of all ages, afflicted with small-pox. Apply at No. 66 Third Avenue.
Fever Hospital...................	58	236	244	78		158		14		25		39	159.83	15.98	The sex of native and foreign-born not classified. A city institution, for the poor of all ages, afflicted with fevers. Apply at No. 66 Third Avenue.
Lunatic Asylum..................	675	680	1,715	194	153	472	896	18	13	41	50	122	71.13	7.11	Application at No. 66 Third Avenue.
Blind Asylum.....................	92	67	150	15	7	71	57	1	....	.....	....	1	6.66	0.66	" " " "
Infants' Hospital.................	419	2,241	2,652	783	958	122	789	373	337	.....	....	710	267.72	26.77	Now on Ward's Island. Apply to No. 66 Third Avenue.
Epileptic and Paralytic Hospital.	130	156	271	49	46	80	61	11	1	13	10	35	129.15	12.91	Application at No. 66 Third Avenue.
Hospital for Incurables..........	120	90	173	10	18	65	80	3	3	20	28	54	312.13	31.21	" " " "
Institutions on Randall's Island:															
Nursery............................	595	1,124	1,124	604	350	79	91	....	...	.....	....	.....	......	......	
Nursery Hospital................	198	735	877	unknown		unknown		22	6	.....	....	28	31.92	3.19	
Idiot Asylum......................	106	39	132	unknown		unknown		3	2	.....	....	5	37.87	3.78	
Hospitals and other Institutions on Ward's Island:															
State Emigrant Refuge and Hospital............................	2,300	11,471	13,911	389	334	8,430	4,758	67	51	301	177	596	42.83	4.28	A State institution, under the direction of the Commissioners of Emigration, for the care of sick and destitute emigrants. Persons of this class may be sent to the office, Castle Garden.
Inebriate Asylum.................	350	1,499	....	306	198	583	412	....	....	1	1	2	1.33	0.13	

NAME OF INSTITUTION.	Present capacity. Number of Beds.	Total admissions in the year.	Total number of cases that received care in the Institution.	NATIVE-BORN.		FOREIGN-BORN.		DEATHS.					Death-rate per 1,000.	Percentage of Mortality on total.	REMARKS.
				Males.	Females.	Males.	Females.	Native Males.	Native Females.	Foreign Males.	Foreign Females.	Total Deaths.			
Dispensaries:															
New York			33,288									119 among district patients	3.57	0.35	The number treated was as follows: Outdoor, males, 9,846, females, 13,152; dentistry, males, 1,446, females, 1,609; vaccination, males, 856, females, 928; indoor, males, 2,184, females, 3,267. The nativity of those who are treated is not asked. Located at the corner of White and Centre Streets.
Northern															Located at the corner of Christopher Street and Waverley Place.
Eastern			25,844	12,304		13,540		23	22	22	23	90	6.64	0.66	The number treated was as follows: Males, 11,342; females, 14,502; of whom 13,698 were adults, and 12,146 children; number vaccinated, 5,489. Located at No. 57 Essex Street.
Demilt			27,416	13,660		13,756						105	3.86	0.38	Located at northwest corner of Second Avenue and 23d Street.
Northwestern		10,419	10,419	3,531		6,888						53	5.08	0.50	Located at No. 511 Eighth Avenue. The records only show the aggregate number of native-born, both male and female, and also of the foreign-born.
Northeastern			11,108	5,527		5,581						58	5.22	0.52	Located at No. 222 East 59th Street.
Manhattan			200	25	15	60	100								Located in 131st Street, between Tenth and Eleventh Avenues. (A plot of ground, corner of 132d Street and Tenth Avenue, has been purchased for the permanent location of this institution.) This Dispensary is not fully organized yet.
Central		4,316		2,300		2,016						40	9.26	0.92	Located at No. 794 Eighth Avenue. Number of prescriptions, 12,110.
Harlem		710	1,226	140	160	196	214	4	4	1	4	13	1.06	0.10	Located in Fourth Avenue, between 124th and 125th Streets.
N. Y. Homœopathic			10,371	6,348		4,023		7	12	8	7	34	3.27	0.32	Located at No. 109 West 34th Street. Of the number treated, 3,885 were males, and 6,486 females.
Orthopœdic		189	227	78	88	29	32	2	3			5	22.02	2.20	Located at No. 1,299 Broadway. The design of this institution is, to provide for the deformed children of the poor "such mechanical and surgical treatment as may be adapted to their needs," more especially for diseases of the spine and hip-joint.
Western Dispensary for Women and Children			1,279					1	1			2	1.56	0.15	Located at No. 218 Ninth Avenue. Of the number treated, 692 were females, and 587 children. Patients are not classified as males and females, only as women and children.

Ophthalmic and Aural Institute..	35	88	890	......	......	......	......	....	....	.....	....	.. ..	......	......	Located at No. 46 East 12th Street.
Society for the relief of the Ruptured and Crippled............	28	2,450	2,833	1,036	705	612	480	2	1	.....	....	3	1.05	0.10	Located at No. 97 Second Avenue.
Homœopathic Medical College Dispensary......................	.....	......	11,180	2,285	3,928	2,128	2,839	5	4	3	2	14	1.25	0.12	Located in 20th Street, near Third Avenue. 739 visits were made, and 63 obstetrical cases attended to.
Bellevue Out-Door Department..	......	......	17,050	2,694	4,041	4,422	5,903	1	....	.....	....	1	0.05	......	Located in Bellevue Hospital Medical College, first floor.
Infirmary of the N. Y. College of Dentistry......................	......	......	....	......	......	......	......	....	....	.....	....	.....	......	......	
Reformatory Institutions:															
House of the Good Shepherd.....	800	629	680	1	680	1	379	....	....	.....	7	7	10.29	1.02	Located at the foot of 89th and 90th Streets, East River. Managed by the Order of the Sisters of Charity of Our Lady of the Good Shepherd, and intended for the reformation of fallen women.
Institution of Mercy..............	75	183	286	......	58	......	125	....	....	.....	....	.....	......	......	Located at No. 35 East Houston Street. Average number of persons who received relief at the institution, not inmates, 2,596; number of visits to the sick and dying poor, 1,414.
House of Mercy..................	44	73	113	......	41	......	32	....	3	.....	....	3	26.54	2.65	Located at the foot of West 86th Street. Receives homeless, friendless girls, from twelve to twenty, shields them from temptation, and seeks their elevation.
Midnight Mission.................	20	200	214	......	128	......	86	....	....	.....	....	.....	... ..	.. ..	Located at No. 23 Amity Street.
Home in West 4th Street.........	35	80	108	......	46	......	60	....	....	.....	....	.....	......	......	Located at No. 86 West 4th Street.
N. Y. Magdalen Benevolent Society.........................	100	126	165	......	105	......	60	....	1	.....	....	1	6.06	0.60	Located in 88th Street, between Fourth and Fifth Avenues. Admits fallen women, who manifest a desire to reform, and seeks to elevate and save them. The common branches of education are taught in the institution, and religions services regularly maintained on Lord's-day.
Home for the Friendless.........	150	610	610	140	193	......	247	14	7	.....	....	21	34.44	3.44	Located at No. 32 East 30th Street.
Women's Aid Society............	50	90	114	......	71	......	43	....	....	.....	....	.....	.....	......	Located at the Northwest corner of Second Avenue and 124th Street.
N. Y. House of Refuge...........	1,000	573	1,534	......	......	......	......	....	...	.....	....	13	8.47	0.84	Located on Randall's Island, N. Y. A State institution, where refractory children, of both sexes, under sixteen, are committed, and placed under wholesome moral instruction, and, in various ways, qualified to earn a living. Office, 516 Broadway. No discrimination is made in regard to nativity, though the majority are foreign. Of the number received, 1,297 were males, and 237 females; number of deaths, males, 11; females, 2.
Five Points House of Industry...	275	1,525	(about) 2,000	......	......	......	......	....	....	.....	....	(children) 7	3.50	0.35	Located at No. 155 Worth Street. At least 80 per cent. of the beneficiaries of the House are foreigners, or the children of foreigners, and 75 per cent. are Irish.
N. Y. Juvenile Asylum...........	700	826	1,421	1,046	131	214	30	....	2	.....	....	2	1.40	0.14	Location, 175th Street, near Tenth Avenue. Admits children of both sexes, who are incorrigible, or destitute. Must be committed by parents, guardians, or the authorities.

Vital Statistics—(Continued).

NAME OF INSTITUTION,	Present capacity. Number of Beds.	Total admissions in the year.	Total number of cases that received care in the Institution.	NATIVE-BORN.		FOREIGN-BORN.		DEATHS.					Death-rate per 1,000.	Percentage of Mortality on total.	REMARKS.
				Males.	Females.	Males.	Females.	Native Males.	Native Females.	Foreign Males.	Foreign Females.	Total Deaths.			
Other Humane Institutions:															
N. Y. Orphan Asylum............	200	12	184	100	84	3	1	....	....	....	....	....	......	......	Location, Bloomingdale and 74th Street. This institution admits destitute orphans, of both sexes, from infancy to ten years.
Catholic Orphan Asylum (Male)..	512	80	571	560	......	11	......	5	....	....	....	5	8.07	0.80	Located in Fifth Avenue, between 51st and 52d Streets. Admits destitute or refractory Catholic boys, from four to nine years.
St. Joseph's Orphan Asylum.....	200	54	205	95	81	13	16	....	1	....	....	1	4.87	0.48	Located at the corner of 86th Street and Avenue A.
Protestant Half-Orphan Asylum..	130	86	313	18	9	34	24	1	....	1	....	2	6.39	0.63	Located in 49th Street, between Fourth and Lexington Avenues. Children, deprived of one or both parents, not under three, nor over eight years of age, are received, with the understanding that they shall be brought up in the doctrines of the Protestant Episcopal Church.
Hebrew Orphan Asylum..........	160	30	180	104	33	28	15	....	....	....	....	....	......	......	Located in 77th Street, near Third Avenue.
Leake and Watts Orphan House..	112	42	167	73	46	19	29	....	....	....	....	....	......	......	Located in 112th Street, between Ninth and Tenth Avenues. Admits orphans of both sexes, from three to twelve years. Supported by endowment from the men whose names it bears.
Association for the Relief of Respectable Aged Indigent Females.........................	86	7	86	......	61	......	25	....	6	....	2	8	93.02	9.30	Asylum, No. 226 East 20th Street. Applicants, who do not become eligible until sixty years of age, must pay $50, and come provided with a good bedstead, bed, bedding, and furniture for a room. Such outfits remain for the benefit of the institution.
Colored Home.......	300	545	790	390	361	27	12	61	50	3	2	116	146.83	14.68	Location, 65th Street, below First Avenue. This institution, managed by an Association of twenty-one ladies, aided by ten gentlemen as advisers, is under the general supervision of the Commissioners of Public Charities and Correction. It combines the double purposes of an almshouse and hospital. A lying-in and nursery department are also attached to the institution. Application at No. 66 Third Avenue.
N. Y. Institution for the Blind....	180	31	158	69	74	4	5	....	....	....	....	....	......	.	Located in Ninth Avenue and 34th Street.

Colored Orphan Asylum..........	250	71	342	210	132	. ....	.....	2	6	.....	....	8	23.39	2.33	Located in 143d Street and Tenth Avenue.
Ladies' Union Aid Society.......	79	9	81	1	55	3	22	....	....	.....	2	2	24.68	2.46	Located in West 42d Street, near Eighth Avenue. Intended as a home for the aged and infirm members, of both sexes, belonging to the Methodist Episcopal Church in New York City.
N. Y. Institution for the Deaf and Dumb.....	550	107	597	.....	......	.... .	. ...	2	. ..	.....	....	2	3.35	0.33	Location, Fanwood, Washington Heights, Bloomingdale Road and 162d Street. The precise nativity of the pupils could not be given. Of the number received, 350 were males, and 247 females.
N. Y. Juvenile Asylum and House of Reception..................	... ..	.. ...	....	. ....	......	.. ...	......	....	....	.....	....	....	......	. ....	
Female Christian Home..	......	.....	....	.....	......	......	......	...	....	.....	....	....	......	......	
Presbyterian Home for Aged Women.	30	7	30	.....	6	......	24	....	1	.....	2	3	100.00	10.00	Located at No. 45 Grove Street. This institution will soon be removed to 73d Street, between Fourth and Madison Avenues, with accommodations for 100. Applicants must be members of the Presbyterian or Reformed Churches, and must have resided in the city for at least three years.
Samaritan Home for the Aged....	45	9	49	10	19	8	12	...	1	.....	1	2	40.81	4.08	Located at No. 175 West 37th Street. Intended as an asylum for aged indigent persons of all Protestant denominations. None admitted under sixty-five years of age.
Orphans' Home and Asylum of the Protestant Episcopal Church...	160	60	178	32	18	3	7	1	....	. ...	....	1	5.61	0.56	
St. Luke's Home for Indigent Christian Females..............	31	4	31	......	9	......	22	....	....	.....	4	4	129.03	12.90	Located at No. 487 Hudson Street. For female communicants of the Protestant Episcopal Church over fifty years of age.
St. Barnabas' House..	50	2,139	7,137	83	622	44	1,390	....	....	....	....	....	......	......	Located at Nos. 304 and 306 Mulberry Street. A temporary home for destitute girls, where they are cared for in various ways. Children are taken during the day, while their parents are at work. In charge of a Protestant Sisterhood. Of 2,139 admitted, 1,237 were Protestants, 901 Romanists, and 1 Jew. Homes were provided for 1,379; 613 removed to friends; 17,057 lodgings were given, and 76,137 meals.
The Sheltering Arms.	95	34	130	58	60	4	6	....	1	.....	....	1	7.69	0.76	Located at 100th Street and Bloomingdale. At the new building, corner of 129th Street and Tenth Avenue, the number of beds will be increased to 120. Admits children of both sexes who are homeless, or whose homes tend to degrade and ruin.
Ladies' Home Mission of the Methodist Episcopal Church, at the Five Points....	. ....	. ....	....	Males. 408		Females. 557		. ..	1	.....	. ..	1	. ..	......	No discrimination is made regarding nativity, though the majority are foreign. Eighteen families comprise together thirty adults and sixty-three children. This has been about the average during the year. Our sanitary regulations are quite satisfactory, being such as to render the services of a physician nearly unnecessary. The 965 pupils visited the day-school.
St. Joseph's Industrial School...	113	110	110	. ....	76	1	30	....	....	. ...	....	...	......	......	Located at the corner of Madison Avenue and 81st Street.
Mariners' Family Industrial Society and Mariners' Family Asylum.........	60	10	59	.....	38	.. ...	21	....	3	.. ..	1	4	67.79	6.77	Location, Staten Island, N. Y. 350 outdoor poor were assisted; among those were poor female relatives of seamen, widows, and young children. Aged women, unable to help themselves, are received.

Vital Statistics—(*Continued*).

NAME OF INSTITUTION.	Present capacity. Number of Beds.	Total admissions in the year.	Total number of cases that received care in the Institution.	NATIVE-BORN.		FOREIGN-BORN.		DEATHS.					Death-rate per 1,000.	Percentage of Mortality on total.	REMARKS.
				Males.	Females.	Males.	Females.	Native Males.	Native Females.	Foreign Males.	Foreign Females.	Total Deaths.			
Other Humane Institutions—(Continued):															
S. R. Smith Infirmary.......... ..	15	81	86	10	4	37	35	1	....	2	1	4	46.50	4.65	Location, Tompkinsville, Staten Island, N. Y. This is a private institution, supported by voluntary contributions, and receives no aid, either from State or County authorities. Established by the Richmond County Medical Society. Is under management of a board of trustees, elected annually by the subscribers to the fund.
Home for the Destitute Children of Seamen......................	65	19	144	86	58	6	2	....	....	.....	....	.....	......	......	
Seamen's Fund and Retreat......	130	929	1,042	133	......	796	......	18	....	38	....	56	53.74	5.37	Located midway between Stapleton and Vanderbilt Landing, Staten Island, N. Y.
Sailors' Snug Harbor............	450	42	436	216	......	220	......	19	....	21	....	40	91.74	9.17	Located at New Brighton, Staten Island, N. Y. During 1869, this institution was entirely free from any epidemic. The deaths are generally in consequence of advanced years, the average age being a fraction over seventy years.
Sanford Hall......................	34	18	47	25	17	5	......	1	1	1	....	3	63.82	6.38	Situated at Flushing, Queens County, N. Y.
Home for Incurables.............	40	20	47	11	12	9	15	1	2	1	3	7	14.89	1.48	Located at West Farms, N. Y. For three years, the Home has received and provided for cases of cancer, of chronic rheumatism, of epilepsy, consumption, and paralysis. In the contemplated enlargement of the charity, provision will be made for every variety of incurable disease, both of mind and body.
Grand Total....	17,325	77,425	231,113	15,733	18,526	28,258	26,286	867	672	1,009	654	4,498	19.46	1.94	

Nativity not stated of............ 27,740 Males.
" " " .... 34,501 Females.

Sex not specified of.............. 33,313 Natives.
" " " .... 38,039 Foreigners.

Nativity not stated of............ 11 Males.
" " " .... 2 Females.
Sex not specified of.............. 145 Natives.
" " " .... 486 Foreigners.
Neither nativity nor sex of...... 652.
} Deceased.

VITAL STATISTICS OF HOSPITALS AND OTHER BENEVOLENT INSTITUTIONS OF THE CITY OF BROOKLYN AND VICINITY.

NAME OF INSTITUTION.	Present capacity. Number of Beds.	Total admissions in the Year.	Total number of cases that received care in the Institution.	NATIVE-BORN.		FOREIGN-BORN.		DEATHS.					Death-rate per 1,000.	REMARKS.
				Males.	Females.	Males.	Females.	Native Males.	Native Females.	Foreign Males.	Foreign Females.	Total Deaths.		
Kings County Hospital	430	2,662	2,979	530	454	1,086	909	47	39	117	84	287	96.33	
" " Nursery	224	483	922	500	301	38	83	19	14	....	....	33	35.79	
" " Lunatic Asylum	700	299	817	161	114	225	317	8	7	15	24	54	......	
" " Alms-House	642	4,108	430	695	881	1,121	1,401	15	12	2	....	29	7.06	
Juvenile House of Industry	90	153	153	141	1	11	......	....	....	....	....	....	......	
Brooklyn City Hospital	250	1,591	1,777	1,670	107	......	......	....	....	....	....	110	61.9	
Long Island College Hospital	99	465	465	78	31	224	132	3	2	16	8	29	62.37	
Brooklyn Eye and Ear Hospital	12	108	108	52	56	63	......	....	....	....	....	....	......	1,315 Outdoor cases treated. }
St. Paul's (R. C.) Female Orphan Asylum	580	28	553	......	505	......	4	....	9	....	4	13	23.5	
St. Peter's (R. C.) Hospital	90	527	800	51	40	207	229	5	1	25	32	63	78.7	Fifty-two of these cases were in last stages of pulmonary consumption when admitted into the Hospital.
Church Charity Foundation (P. E.)	50	18	86	41	28	3	15	....	1	....	....	1	11.6	
Brooklyn Home for Destitute Children	100	100	90	......	......	......	......	....	1	....	....	1	11.1	Fifty males, forty females, nearly all foreign.
Graham Institution	56	6	46	......	24	......	22	....	6	....	....	6	13.0	
Orphan Asylum	126	57	42	8	6	16	12	2	....	....	....	2	41.62	
Total	3,449	10,605	9,268	3,927	2,548	2,993	3,124	99	92	175	152	628	......	

"D."

Office of Counsel Metropolitan Board of Health,
New York, *January* 5, 1870.

The Secretary of the Metropolitan Board of Health:

The fact that, in making my fourth annual communication as counsel of the Board, I find no circumstance or proceeding of especial interest to report, and that, in regard to matters pertaining to my department, the business of the Board has proceeded with regularity and order, without encountering either hostility or serious opposition, is, perhaps, the highest evidence that can be adduced of the success of the administration of the health laws of the Metropolitan District.

In my report for last year I was able to congratulate the Board upon the successful termination of the struggle, foreseen from the beginning as inevitable, between the Board and those elements in the community that rebel against those restraints which it is one of the primary objects of a Board of Health to impose. That struggle related to, and indeed boldly challenged, the fundamental and essential principles of law and policy on which the Board is based.

Those principles sustained, and that contest over, the Board is left to attend to the details of its practical duties, and, during the past year, it has done so with efficiency and success.

The report of the attorney so fully presents the details of the litigation that any further explanation as to those matters would hardly be useful.

I see more and more evidence in my department that the Board has secured that measure of public confidence and respect, and that its legal authority is regarded as so fully established, that there is less need than formerly of resorting to actual litigation to attain the results which are within the duties of the Board. It is true the Board has not been able in several particulars, as, for instance, in respect of gas and fat-rendering, to prevent the creating of offensive exhalations, yet great improvements in nearly every such instance have been secured, and the foundation has been laid for reforms sure to be soon accomplished, but which the exigencies of existing business arrangements would not permit to be at once perfected.

And there can be no doubt that the reports made by the Board, its own investigations, and the spirit of inquiry which it has awakened in the whole community, have done much—perhaps even more than all active coercive measures—to prevent and remove the causes of disease and unhealthy annoyance in the sanitary district. In a community so intelligent and sagacious as this, it is not the actual exercise of power alone that prevents and removes evils; the demonstrated facts of their existence and of their being impending, with explanations of their dangers and of the best means for their removal, are all that are needed to secure relief from a great portion of them; and no small share of the residue are abated merely because their authors perceive that there is near them a power adequate and disposed to require their abatement, which can neither be bribed nor intimidated. And by such methods the Board of Health has perhaps been the occasion of greater works of sanitary reform than all those of which its voluminous records contain the history.

But, when all such influences have failed, the Board has not hesitated successfully to exert its legal authority, and the volume of its reports attests its efficiency in so doing.

Yet, wishing gradually to accustom the community to habits of sanitary precaution and justice, the Board has exerted its extreme power but in rare instances; as, for instance, during the prevalence of the small-pox and the cholera, and with what beneficent results in these cases it does not fall within my province to relate.

There are some features relating to the legal history, organization, and jurisdiction of the Board, as to which, after so long an experience, it will be safe and proper to speak.

1. When the existing health laws were enacted, in 1866, the health tribunal of the city of New York, if, indeed, any organization existed that merited that name, was made up of unorganized elements, and clothed with indefinite and inadequate powers, and it was without the capacity of efficient action. Some of the principal officers were so advanced to their places that they were not likely to, and in fact did not, possess the requisite qualifications, and they were without the means of securing such united harmony and action as would command public confidence or obedience. In the subordinate places, such as the wardenship, were men whose duty it was to make public inspections for causes that endangered the public health, who were not only disqualified, but who were a positive disgrace to the public service; and the whole sanitary administration of the city was inefficient, and was generally distrusted and feared.

A large percentage of the health officers were keepers of disreputable grog-shops or corner groceries.

2. There was one organization for the city of New York, another for Brooklyn, and still others for the several towns and villages (in this State) around the bay of New York, and there was and could be no harmony and concert of action in resisting the common dangers to the health of the whole district. It is plain that there can be no adequate sanitary administration to protect the health of New York and Brooklyn and the adjoining villages, of which the inhabitants do business in one and reside in another; none to secure protection against diseases coming in on ships from the ocean, from which cargoes and passengers land and pass all along the shore short of a central jurisdiction, like that of the present Board, which shall extend over the whole district.

3. No Board of Health could secure influence enough to accomplish the reforms and command the respect I have mentioned, unless it had the right to ex-

amine into and decide in the first instance the almost innumerable abuses that, in crowded cities, come before such a tribunal and require speedy action. And hence this Board was wisely clothed with such powers. And the striking fact that, though the power of review on *certiorari* has existed in each of the many thousands of instances in which the Board has exercised that power, it has never been finally invoked with success, is the best commentary upon the justice with which the Board has used its authority, and of the safety of delegating such powers to a Board properly constituted and filled.

4. And for the reason that no such Board would have ready and adequate power of causing to be carried into effect its directions requiring prompt execution, the members of the Board of Police were made members of the Board of Health, and the police force was placed in such relation that they would in all proper cases be made readily serviceable for the protection of those aggrieved by nuisances dangerous to life or health.

5. The Health Officer of the port of New York being likely, from the nature of his duties, to be intimately acquainted with many sources of danger to the public health, and it being desirable that all officers clothed with any power or duty of a sanitary nature should act together, that officer was made *ex officio* a member of this Board, and his presence has been found of great advantage to the public service.

6. To those five officers were added two experienced physicians from New York City, and one from Brooklyn, and another member not a physician, making up a Board of nine, with a tenure of office so long that it was possible to acquire adequate experience in official duties before the official term should expire.

7. Upon this Board was conferred all the power and authority relative to the protection of life and health in the Metropolitan Sanitary District which had been delegated by any existing law, and certain additional powers of a limited character were also given, thereby securing unity and harmony of action.

8. Thus made up and clothed with adequate power, the Board, so far as my department has been concerned at least, has been enabled to act with harmony and energy, and the health laws have been administered according to their legal effect and spirit. I am not aware of any complaint that the Board has exceeded or failed to come up to the substantial measure of its official duties, nor that any portion of the public money has been lost or misapplied.

9. For the first time in this State (except to a limited extent in the law creating a paid Fire Department) a provision was inserted in the law creating this Board (and it remains unchanged), to the effect that any citizen charging that any member, officer of this Board, had been guilty of any neglect or dereliction of duty, could, on the request of such citizen, have such alleged delinquent publicly examined under oath in respect thereto, before a justice of the Supreme Court; and in view of the fact that, though so many have been restrained by the action of the Board, no one has ventured to make any such charge, it may, I think, be fairly concluded that there have been no such abuses to be complained of.

These and other considerations connected with the present health laws and their administration, have attracted great attention to them in this country and abroad, and in more than one State they have, I am informed, been made the basis of similar legislation.

10. I am satisfied, from the experience of my department, that it is indispensable to the success of any efficient health laws, that the tenure of office of those who are to administer them should be at least as firm and independent as those conferred by the laws creating this Board. For strong solicitations and bold threats are not unfrequently used by those affected by its action to secure impunity; and it is natural that those engaged in the unhealthy but profitable pursuits a Board of Health must restrain, should combine their influence to resist its action. And, in my opinion, if the time shall ever come when the members of the Board shall hold their office practically at the mercy of such portions of the community, its efficiency and utility will be in a great measure lost.

There is no field of official duty in which sound judgment, personal integrity, and a strong purpose to discharge public duty, are more indispensable, or in which the absence of them would be more pernicious and dangerous, than in the administration of the health laws of this Sanitary District. I trust my relation to those laws and their administration, and my deep interest in the subject, may excuse any digressions in this report.

Your obedient servant,
D. B. Eaton,
Counsel Metropolitan Board of Health.

OFFICE OF THE ATTORNEY, METROPOLITAN BOARD OF HEALTH,
No. 301 MOTT STREET, NEW YORK, *November* 1, 1869.

COLONEL EMMONS CLARK, *Secretary, etc.* :

DEAR SIR: The record of the operations of this Department, during the past year, presents little to call for comment. The system adopted, near the close of the previous year, of enforcing by actions in the courts the orders of the Board as well as the provisions of the Tenement-house law, has been continued with the same good results, and has, of course, produced a continued mass of litigation. The Board also passed an ordinance intended to regulate the use of kerosene as a burning-fluid. Under it many suits were commenced. A question of the right of the Board to maintain these last-named actions was soon raised, and at the close of the year had not been decided. The right of the Board to remove stalls from the public sidewalks has also been again litigated in what is intended to be a test case. Justice Lane, of the Sixth District Court, has decided against the Board, and an appeal has been taken to the Court of Common Pleas, where the question is expected to be argued in January. During the last winter, a question was raised as to the constitutionality of the act making a jury in a Justice's Court consist of only six persons. Justice Lane decided the act unconstitutional, and, as there was no power to summon a jury of more than six in such courts, the litigation of the Board seemed likely to be greatly impeded. An application was, however, made to the Supreme Court for a mandamus, which was granted, that court holding that the act is constitutional. Pending this decision, an act, drawn by me, was passed by the Legislature, which, by giving the right to summon juries of twelve in such courts, prevents any obstruction to the litigation, even if the decision of the Supreme Court should be hereafter reversed.

In my last report, I stated that "the demurrer, in the case of the Idaho, argued before Judge Daly, of the Court of Common Pleas, on May 14, 1867, has not been decided by him. I presume, from the length of time that it has been retained under consideration, we may soon expect a learned and elaborate opinion." As the case has not yet been decided, I must apologize to the Board for having been led by my naturally sanguine temperament to underrate the time necessary to investigate the questions involved.

There have been brought, during the year, in the Justice's Court of the Sixth District, nearly 5,000 actions; these are in addition to those which were pending at the date of my last report. Of these, six-sevenths have been disposed of.

With few exceptions—generally in cases where the wrong person was sued—a compliance with the law or order of the Board has been obtained in all cases where the action has been disposed of.

There has been collected, in these actions, and paid to the Treasurer during the year, by way of costs and penalties, the sum of $9,194.09.

The number of actions ordered brought was not less than ten thousand. In those not brought, with few exceptions, a notice of intended suit produced a compliance with the law.

In an action brought in the Supreme Court in Westchester County, the Board was attempted to be charged with the expense of a small amount of work, done at Sing Sing, by a person who did not comply with the regulations of the Board, relating to securing payment from the owners of the property. The action was defended vigorously, because there was a large amount involved in similar claims in Kings County. A decision has recently been rendered in favor of the Board.

In an action in the Superior Court, brought against the Board, it has been decided that the only way to cancel a lien filed by the Board is the one pointed out by statute.

The laws relating to your Board are defective in two respects, one in not providing a mode of service upon absent or unknown owners, and the other in not providing sufficiently for the removal of nuisances common to several owners.

Your obedient servant,
GEORGE BLISS, JR.,
Attorney Metropolitan Board of Health.

ENGINEER'S OFFICE, METROPOLITAN BOARD OF HEALTH,
NEW YORK, *December* 31, 1869.

To the Secretary Metropolitan Board of Health :

The duties of the Engineer, and the work of his department, have not been less during the present than in previous years, but they have been rather of examination and revision, than of construction, the honorable Board having decided to prosecute parties for non-compliance of its orders, rather than to enter on premises and execute these orders.

Of the complaints of Inspectors referred to the Engineer, one thousand eight hundred and eighty-six have been indorsed with "Special Orders," eight hundred and forty with general orders, and some have been negatived. Of all the complaints referred to me, at least one-fourth have been reinspected. Requests by owners of tenement-houses of the Board for a stay of proceedings in cases of infringements of the Tenement-house Act, have been usually referred to this department for Report, and many citizens' complaints, which have been deemed by the Sanitary Superintendent more within the Engineering than the Sanitary Inspector's Department, have been investigated.

In the carrying out of these investigations, the Engineer has had the benefit of intelligent and practical aid from the officers detailed for that purpose by the Board. Sanitary Policeman John Brady, who has been in this office from May, 1866, to September, 1869, and Mr. John Ingram, a practical plumber of many years' standing in this city, my assistant since May last, have performed their duties faithfully. Both of them have invariably, in a quiet way, tried to have nuisances abated promptly by owners or agents, without recourse to complaint and service of orders. Much has been done in this way, of which there is little record in this office, but much in outside credit to the Board.

The classes of complaints have been much the same as in previous years, dirty, leaky privies, obstructed sewer-pipes, broken hydrants, sunken lots, gutters, and curbs, leaky roofs, etc., etc. But most of the nuisances complained of are less in degree latterly, functional rather than structural derangements, due more to the tenant than the landlord. Actions at law have demonstrated to the latter the necessity of complying with sanitary requirements ; but it has not reached the former; and among these where ignorance and selfishness prevail, there is a necessity for police supervision. In dirty houses with all the surroundings of filth and wretchedness I have found single families keeping their own apartments neatly and cleanly, but compelled to use in common with their filthy neighbors the privies and water-closets. In all tenement-houses there should be some responsible head to protect the neat, and compel the dirty to keep clean.

The Tenement-house Act requires certain windows to be cut in halls and bedrooms, with openings in the sky-lights for ventilation. The act is good in so far that, the more the openings that are made, the better the circulation; but it is questionable how much morality may be improved by destroying the privacy of apartments. Besides, the ventilation secured is only summer ventilation; the landlord may put a ventilator over his hall; he may cut windows into the hall bedrooms, and construct flues in the inner chambers, and the tenant may be grateful for them in summer when the draft is outward; but when winter comes, and fires are kept constantly lighted, the air for the combustion of the fuel comes in cool through cracks and in flues, and he closes up all apertures that he can. Perhaps, poorly clad and ill fed, he would rather suffer from vitiated air, if it be warm, than from fresh and cold draughts.

Fig. 1 represents the plan of a common form of tenement-house, two suites of apartments on each flat; and Fig. 2, four suites. The law requires windows w, w, w′, w′, through hall-walls and dividing walls of bedrooms, and also into the living-rooms. To the latter, being usually transom windows over the door, there is but little objection; but to the former, and especially among the better class of tenants, there is great complaint of the loss of privacy to the bedrooms, that these windows cannot be opened without the occupants being overheard in halls and adjoining rooms, and being seen by persons passing up or down stairs. In Figs. 3 and 4 I have modified the plans to obviate, in a measure, these objections, and to avoid the tenement-house look in the hall. In Fig. 3 a light-well and ventilating-shaft (v) is introduced between the two interior bedrooms, into which windows open from all the bedrooms. In Fig. 4, the ventilating-shaft (v) is between the bedroom and living-room, with windows into bedroom, living-room, and water-closet. Recesses (r r) are for beds, which may, or may not, be enclosed by folding-doors.

FIG. 1.

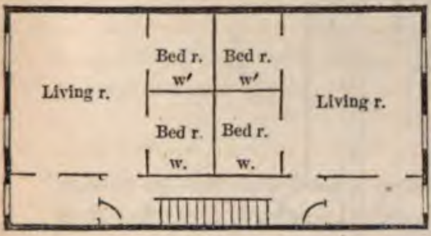


FIG. 2.

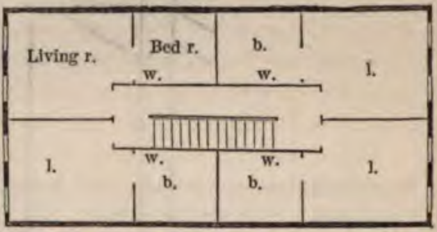


Fig. 3.

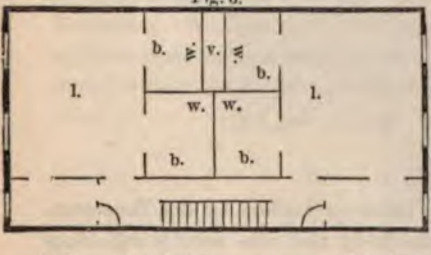
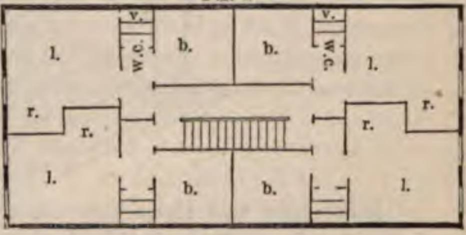
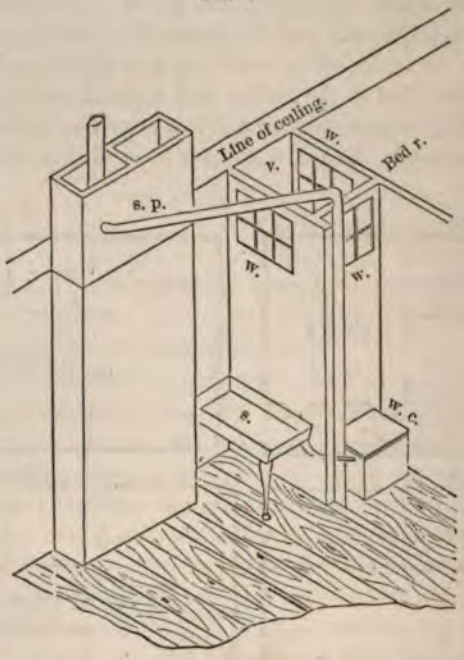


Fig. 4.



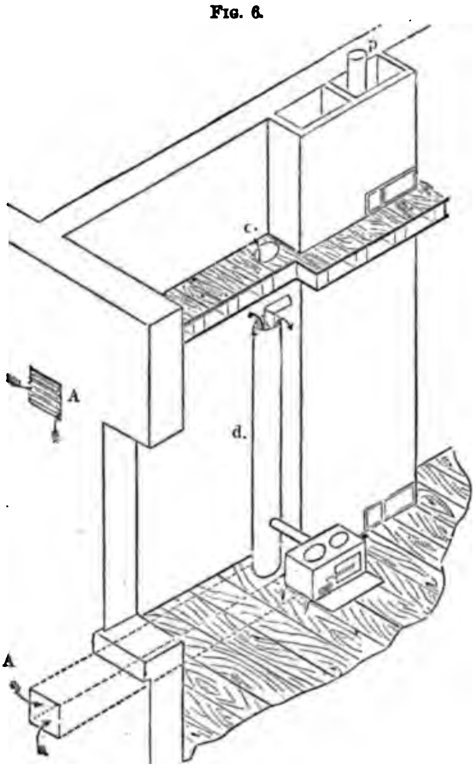
It will be observed that, in Fig. 4, a water-closet (w c) is introduced; the small pantries (Fig. 3) could be used for the same purpose. It would be better and cheaper for the landlords, that every suite of rooms should have its own water-closet, for which the tenant should be held responsible. If a branch from the soil-pipe be connected with the hot flue of the chimney, either at top or bottom, a draught inward will be induced in it which will prevent any smell escaping into the interior of the house, especially if the lids of the water-closet seat be kept closed. A simple trap at the foot of the soil-pipe would be sufficient with a cheap hopper flushed by the sink-water only. Fig. 5 is an isometrical section, of which Fig. 4 is the plan, showing the position of the water-closet (w), soil-pipe (s p), its connection with chimney-flue, the sink (s), its waste-pipe to the water-closet, also the windows (w w w) opening from ventilating-shaft (v) into bedroom, water-closet, and living-room. This shaft should be carried well above the roof, covered with glass skylight on top, and open at the sides.

FIG. 5.



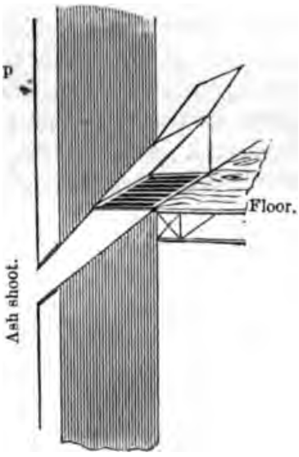
It has been said above that the ventilation prescribed by the Tenement-house Act is mostly applicable to warm weather; that the tenants will close the apertures on the approach of cold. Morin, in his "Manuel du Chauffage," gives a common and practical way of introducing warm air into rooms heated by grates or stoves. The smoke-pipe or flue is of iron, enclosed in a brick chamber or flue, into which the exterior air is introduced at the bottom, and discharged just below the ceiling of the room. In Fig. 6, which is an isometrical section of two floors of a tenement-house, is shown a modification of this apparatus. A A are the exterior openings of the air-ducts, which pass between floor and ceiling of room, opening through the floor, as shown at (o) or upper floor. Around this opening (see floor below), a metal drum (d) is constructed attached to the floor and open near the ceiling. The stove-pipe passes horizontally into the drum, and out at the top into the chimney. The exterior air passing

FIG. 6.



through the duct and into the drum is heated by the stove-pipe and discharged at the ceiling, as shown by the arrows. The quantity of air to be controlled by some damper in the duct. Two flues are shown in the figure; one only for smoke. A single flue of adequate size has been found in English tenement-house experience to answer for all the stories where the stove-pipes are introduced with a discharge upward. The other flue is intended for ventilation.

FIG. 7.



Within this flue is a pipe (p) for an ash-shoot, connecting with a tight bin in the cellar. Ash-shoots and bins are common in other countries, but are not usual here; and they are a very great convenience to the tenants, and do away with the ash-barrels in the streets. The opening to this ash-shoot is on a level with the floor to admit of the dust of the room being swept into it. It is shown on a larger scale (Fig. 7.), with the lid open. A grating prevents the passage of improper substances which might choke the shoot.

The Croton Board and Brooklyn Board of Sewers during the present year have prosecuted their work of sewer construction in the streets, and, as fast as completed, your inspectors have invariably inspected premises on which nuisances could be abated by sewer-connection, and orders for the same have been indorsed and issued.

The following table exhibits the income from sewer-permits to the Croton Aqueduct Department, and the number of sewer-permits taken at the Brooklyn Department from year to year:

January 1, 1861, to December 1, 1861	$15,981 00
" 1862, " 1862	14,193 00
" 1863, " 1863	16,169 00
" 1864, " 1864	15,375 00
" 1865, " 1865	16,393 30
" 1866, " 1866	29,775 50
" 1867, " 1867	47,895 50
" 1868, " 1868	32,791 00
" 1869, " 1869	27,786 50

Number of connections made with sewers in Brooklyn:

1859	422
1860	1,695
1861	4,895
1862	3,168
1863	1,948
1864	1,301
1865	1,518
1866	3,605
1867	2,922
1868, to November 1st	2,768
1869, to December 1st	3,388

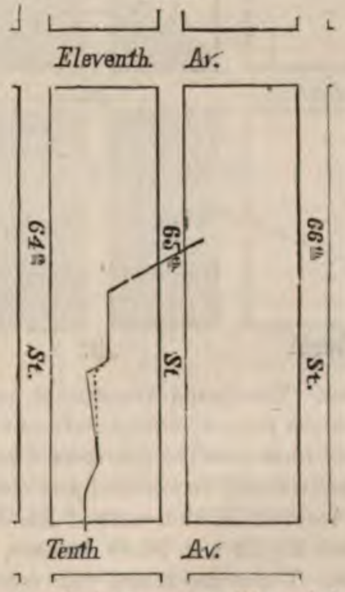
The utilization of sewage has long been a problem to sanitarians and economists; the precipitation of its valuable matters by chemical means and by subsidation, and then transporting them in a semi-fluid or dry state, has not yet proved practical. But, when sewage can be pumped in a liquid form, and distributed directly upon land, it has invariably, I believe, been successful and remunerative in the vast increase of agricultural products. It is the cheapest way of applying manures, and least offensive, all smell, if any, disappearing in a few moments after its application, and sinking into the earth; the roots and fibres grasp every thing nutritious to them, and the water, percolating into the underground drains, becomes pure to taste and analysis. It is evident that, in the country, tight cesspools should be the rule, and the sewage distributed by hand over field and garden; but, in the city, there are only the parks to which the sewage can be applied, and the sooner some arrangement is made for thus utilizing a portion of our sewage the better. The system of sewage is not so far carried out both here and in Brooklyn, but that the sewers around the large parks could be diverted into large subterranean tanks within the enclosures. Water must be provided, and this affords the readiest and best means. There can be no offence of smell where the waste is diluted by 60 gallons at least to each inhabitant. At Kings County Buildings an open cesspool, many years a nuisance, receives all their waste; using 260,000 gallons on an average per day, at least 200 acres would be well irrigated and manured, and with profit, where now a product, worth at least 20 dollars per day, is wasted in the cesspool.

The Counsel of the Board, having decided that the abatement of the nuisance of sunken lots lay within the province of the Board, drew up the following form of order:

"At a meeting of the Metropolitan Board of Health, held on the day of , 18 , at said office:

"The premises hereinafter named having been and being, in the opinion of said Board, and in fact, in a condition and in effect dangerous to life and health; and said Board having taken and filed among its records what it regards as being, and what is sufficient proof to authorize its declaration that the same is, a public nuisance and dangerous to life and health, said Board does hereby enter the same on its records as a nuisance, and makes in respect thereto the following order, to wit:"

Fig. 8.



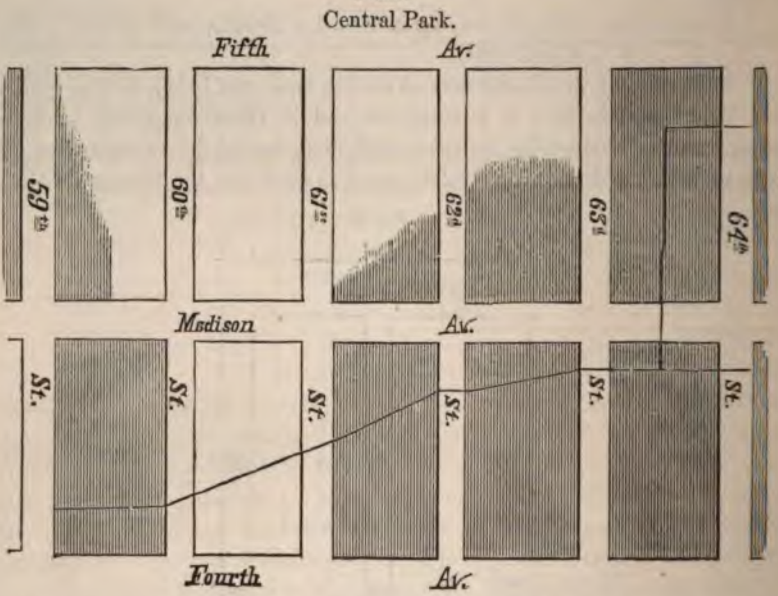
"*Ordered*, That a sewer be constructed," etc.

Supported by this decision the inspectors have again made complaints of several sunken lots and squares in the upper part of this city, old and long-standing nuisances, and the Board has issued orders for their abatement.

Within the squares bounded by Sixty-fourth and Sixty-fifth Streets and Tenth and Eleventh Avenues there has been a very great collection of stagnant and offensive water. The order was for the construction of a box drain on the line, as shown in the accompanying sketch, Fig. 8. The line was varied somewhat by the proprietors to suit their construction; but the line was made continuous, and without injuring the efficacy of the drain. The full line is as it was constructed. The drain across Sixty-fifth Street was cleaned by the Croton Board, and its continuation to Sixty-sixth Street by the Metropolitan Gas Company.

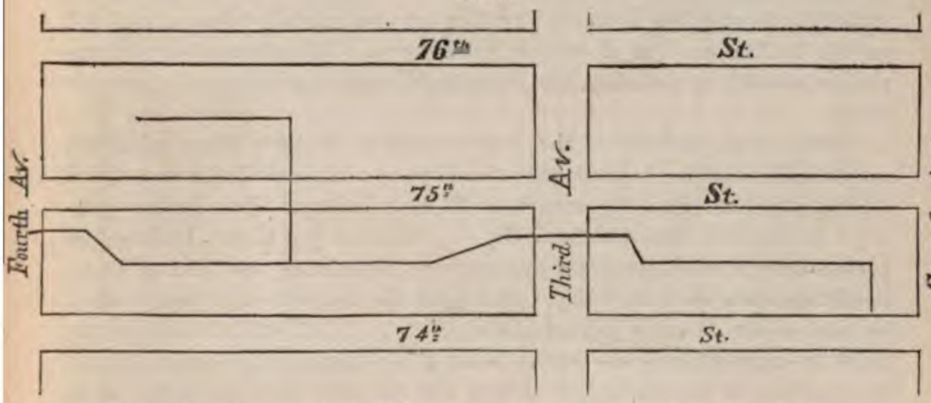
Similar orders were served on certain owners of premises between Fourth and Fifth Avenues, and Fifty-ninth and Sixty-fourth Streets. The line of construction is shown on the accompanying sketch—Fig. 9—shaded portions represent the stagnant water. The Croton Department have finished the culverts beneath the streets, but the property-owners have not yet complied with the orders, although some of them have brought stone for the construction of the drains. All of these orders should be executed previous to filling up the lots.

Fig. 9.



Similar orders have been served on owners of lots between Sixty-fifth and Sixty-seventh streets and Eighth and Ninth Avenues, but nothing has been done toward compliance. When the Board first came into existence great complaints were made of the squares bounded by Seventy-fourth and Seventy-sixth Streets and Second and Third Avenues, and the Street Commission and Croton Department were requested by the Board to abate the nuisance. Both departments did not consider it within their duties to do the work, although much of the nuisance resulted from a blocking up of the old drain across Second Avenue, during the construction of a sewer in that avenue, by the Croton Department. The Street Commissioner was to bring the matter before the Common Council, but nothing was done. This year, Sixty-fifth Street having been graded from Second to Third Avenue, and a portion of the pond filled in thereby, the Board have issued orders for the filling in of the lots to a level of 6″ above the level of stagnant water, it being the intention of the Engineer to recommend, when these were complete, the construction of a drain in line, as shown in the accompanying sketch, Fig. 10. Part of this plan has already been executed on the westerly side of Third Avenue, and the Croton Department have been requested to make an opening into the Sixty-fourth Street sewer at a point eighty feet west of Second Avenue. When the whole plan is carried out there will be a good sub-drainage below the level of the street sewers on the territory extending for the width of two squares and from Second to Fourth Avenue.

FIG. 10.



There is a large extent of low ground, west of Eighth Avenue, between Seventy-fourth and Seventy-seventh Streets, covered mostly with stagnant water, which every year will become more and more of a nuisance, as squatters congregate around its border. It now furnishes a supply to one of the ponds of Central Park. There should be drains constructed here, and then well covered with earth to protect this source of supply from contamination. Other stagnant lots have been complained of. Where connection with street-sewer could be effected, such order has been indorsed; but many offered no remedy except the opening of old drains and water-courses, and they have been so indorsed. On others delay has been recommended till the street-sewers are complete.

Of the outlying districts very little can be said in the way of drainage. Flushing has had a drainage commission which has been quite active; and the whole of Morrisania has been surveyed for a complete system of sewerage.

In Edgewater, Staten Island, commissioners have been appointed under the Act of 1868, and surveys have been made, but no plan has been acted upon. Throughout the whole Metropolitan District, outside the limits of Brooklyn and New York, it is felt by all intelligent persons that there is an absolute necessity that powers of sewerage and drainage should be conferred on some Board or other. Not only are there many ponds and swamps that both for sanitary and agricultural purposes should be drained, but in the rapidly-growing towns and villages the earth is becoming saturated with the waste of houses and the leakage of privies, and the water-supply from wells is becoming contaminated, and drainage becomes also an important question as a source of water-supply, while sewerage looks to the removal of all noxious fluids by entirely separate constructions. In my report of 1866 I recommended the use of slip-boxes for country privies, with the use of sulphate of iron or lime or common earth as disinfectants. Since that time the earth-closet has been introduced in this country, and parties using them report them as a success. They were used at the skating-pond in Prospect Park, and the engineer, Mr. C. C. Martin, reports to me that "there were eight of them in rooms heated by stoves, and the same rooms, only separated by a partition or screen, were occupied by ladies and gentlemen without annoyance, and even without the knowledge of the existence of the closets in many cases." I have examined the machinery of these closets and find it very simple, and cannot see but that, with the exception that the earth is to be supplied by hand, why they are not as easily taken care of and as little liable to get out of order as water-closets. Where water is to be supplied to a closet by pumping, the labor would rather be in favor of the earth-closet.

Owing to the lateness of the season at which the Astor Place urinal was adopted, the stone for its construction could not be delivered till this season, and the urinal was not ready for occupancy till early in May. From its first opening it showed the imperious necessity of some such provision. In June 986 persons were counted going into the men's division during the thirteen hours that it was open on a single day. In August the men's division was enlarged by moving the partition toward the women's part, but without reducing the closet accommodation of the latter. With this enlargement the male frequenters continued to increase, so that at least 300,000 have made use of the inside of the urinal since its erection, and numbers more of the outside at night. The greatest number of women making use of their division has been twenty-five in a single day.

Of the necessities of such edifices both for men and women there can be no doubt, and of the appropriateness of this locality for one. But, as one where there should be many, it undertakes the relief of too large a population and district, and is too small. The attempt to keep the men's division clean by the once-a-day supervision of a woman, and by structural means guard against misuse, and the closing of the building evenings, have been mistakes. In the opinion of your Engineer, it has been clearly proved, by the experience of the urinal in Astor Place and City Hall Park, that these indispensable structures should have some competent person in charge while they are in use, as at our frequented hotels; that these accommodations should be of the best character, tending rather to bring up the sense of decency in the users than degrade it. In an educational point of view well-kept public urinals may serve as powerful assistants to Boards of Health, as examples of what can be done to render such structures comfortable and inoffensive; they will introduce among our lowest classes habits of cleanliness and self-respect, that will improve the condition of our tenement-houses, and enable landlords to make improvements by substitution of water-closets for privies, which now would be worse than useless.

The Board have referred to me for a report on garbage-boxes. I have carefully looked at the boxes offered for your inspection, and have investigated the garbage question as worked in other cities. The box placed beneath the sidewalk opposite the Police Headquarters, seems to answer a very good purpose; but is costly, and may be a nuisance in winter weather. It does not seem to me proper that garbage should ever be brought into the street, except when it is emptied into the cart; any receptacle for garbage must become offensive, and there seems to be no good reason why this smell should be put where it must be offensive to the greatest number of persons. In Boston, the ashes and garbage are kept distinct, and within the limits of the premises. The dirt-collecters go in and bring out both of the two products, which separate are of value, the garbage for swill, the ashes for the grading of streets and lots. On the recommendation of your Sanitary Committee, I conferred with the executive officer of street cleaning, to see whether, in case the Board would exert its authority to have the ashes and garbage kept in different boxes, he would order his men to go into the back yard of tenement-houses, or beneath the stoops, to remove the contents. On consultation with the contractors, it was declined. This plan should, however, be adopted. The mere form of the receptacles is of but little moment; a barrel, preferably of iron, with the garbage well covered, should be introduced, the occupants to be responsible for the cleanliness of the receptacles, which should be kept where they shall not be offensive to others.

Your Assistant-Sanitary Superintendent, Dr. Morris, has for years in his house been in the habit of disposing of all the garbage by burning. It is hardly possible that this would be applicable in boarding-houses and hotels, but it seems very probable that if, in every suite of apartments in a tenement-house, there were ready means of getting rid of all liquid waste into the sewer-pipe, all the garbage might be disposed of in the cooking-stove. With the addition of an ash-bin and shoot, the great nuisance of garbage-boxes in the street might be entirely done away with.*

At the request of the Sanitary Committee, I have visited very frequently the rendering dock at the foot of Thirty-eighth Street and North River, to see whether some construction might not be suggested by which the very offensive smell might be abated, and the business still carried on. Without a radical change in the whole arrangement, in both apparatus and structures—the substitution of iron in the place of wood, of a non-absorbent material instead of one which, receiving odors and offensive waste into all its pores, in time becomes of itself a perpetual offence; and the location of the buildings on the pier, beneath which iron boats might pass, and into which the offensive material might be directly discharged and tightly closed—there seems to be but little chance of abating the nuisance. And it is very questionable even with the best arrangements that could be devised, whether the escape of offensive odors might not be more than should be permitted within the city limits, and as a matter of experiment it should not be tried here. It is not implied by the contract that a tallow and manure factory should be established in our midst, nor is it necessary. Offal and dead animals can as readily be removed as the manufactured products; and at Barren Island, or some similar locality, the manufacture can be carried on without offence to any neighbors. But, wherever treated, the constructions that may be necessary for the cheap and ready doing of the work are the very ones which will tend to abate the nuisance, and, if the stench can be entirely reclaimed and absorbed in the material manufactured, the quantity or quality must be increased.

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* Mr. W. R. Gilbert, of Darjeeling, India, has invented a process for the disposal of the products of dry sewage by burning. F. J. Mouat, M. D., inspector-general of jails in the lower provinces of India, speaks very favorably of Mr. Hickey's process, and Mr. Hickey thus speaks of it himself as "the carbonization or dry distillation system of conservancy:"

"This system proposes to render filth of all kinds innoxious, by carbonizing in close retorts—using the residue in the retorts for deodorizing fresh filth in transit to the apparatus, utilizing it and the products of the distillation for manure—the gas being available for heating or lighting purposes, or for both.

The system may be divided under three heads:

1. When the gas is to be utilized only for heating the furnaces.
2. When the gas generated from the filth itself is to be partially or entirely used for illuminating purposes.
3. When the gas from the filth is to be utilized for heating the furnaces, and fresh gas made at small expense for illuminating."

The filth carbonized by these systems, Mr. Hickey remarks, is at once and forever rendered innoxious even on its journey to the apparatus. It can never regain any of the objectionable qualities of filth. The vitality of all organic bodies is destroyed. The poudrette (carbonized residue in the retorts) is a black powder, perfectly free from smell, and is an admirable deodorizer for solid and liquid filth.

The gas yields a very brilliant light, and is perfectly unobjectionable. The poudrette and the refuse in the condenser, etc., contain animal and vegetable charcoal, with phosphates, carbonates, and sulphates of potash, soda, magnesia, lime, iron, etc., the mineral or earthy materials of plant-food, and also ammonia and carbonic acid, which are the organic materials.

The prime cost of the apparatus, he says, is trifling, and the system will be self-maintaining as regards fuel for the furnaces.

He claims for his invention that it is perfect in a sanitary point of view; that it is economical; that the manure is of first quality, portable, and innoxious; that the gas is luminous and innocent; and that the poudrette is a perfect deodorizer for solid and liquid filth.

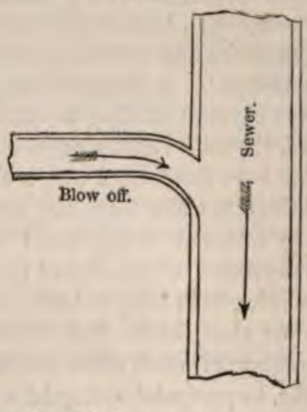
Manure and Garbage Docks.—The piers and docks for reception and discharge of garbage, street-dirt, and manure, are in this city of the most unsubstantial construction, as if the requirements were but temporary, and something was to soon happen which would do away with their necessity; yet in garbage and street-dirt there are delivered by contractors, on board of boats, 900,000 cubic yards per annum, to which must be added surplus earth in the excavation of the cellars of buildings, and the manure of from 60,000 to 65,000 horses. Where garbage and ashes are kept separate, the former alone would have to be removed from the city, as it has been demonstrated by actual use that there is no better substratum or foundation for the pavement of streets than coal ashes; and for the filling of lots below grade they are better than earth or gravel. In Boston all the garbage-carts deliver their load at a single depot, where swill-carts from the country come to receive it. The carts that collect and transport it, are tight, with close covers; it is collected and carried off early in the day, and the depot is kept clean and well washed. In this city the means of transport in barges and steam-tugs would afford better facilities than in Boston, and the localities for its consumption may be much more remote. For the garbage as well as street-dirt and surplus dirt, good substantial piers should be erected, on which should be placed large hoppers or bins, elevated to such heights that they could be readily emptied into barges by inclined shoots, with drive-ways, so that the wagons and carts could be drawn up and discharged into the top. For manure-dumps some similar arrangement should be adopted, but the manure as delivered is composed of two different materials, dung and straw, which it is as important to separate as garbage and ashes. The dung is valuable for itself, but the straw is almost worthless till rotted, and on this account it has been very common to stack the manure on the dock, and hold it till time has incorporated the straw and dung in one—a nuisance which has been a frequent source of complaint to your honorable Board. Through improper use of straw for horse-bedding, the small space and opportunity for drying, and the objections of parties near to stables to having it spread to dry, the result is that by far the largest portion of the manure delivered at the docks is straw. The yearly quantity of manure must be equal to 100,000 tons, of which at least two-thirds is straw, the latter being in its unrotted condition, not worth the cost of transport. The straw could, I think, be separated from the dung by machinery, and baled or washed, and used for straw paper; or, if burned in furnaces with a high chimney, the profit to the manure contractors would be nearly as great as at present, and the nuisance to the city much less. The transport of the residuum, much more valuable as a manure, would be only one-third of the present. This could be thrown out from bins, like those proposed for garbage and street dirt, the barges readily loaded, and offence from demurrage and storage almost entirely done away with.

There have been some complaints, both in this city and Brooklyn, of smoke from the chimneys of manufactories and workshops, and some orders have been indorsed to extend the chimneys to a height of ten feet above the roofs of houses adjacent. Should the adjacent building be carried up, or new buildings of greater height be erected, the same remedy again would have to be applied. Many of these chimneys have been constructed with too small a base, to prevent them to be raised with brick-work, and a temporary expedient has to be substituted of iron pipe, stayed by iron rods or guys; and it would seem expedient that there should be some regulation of this Board that should require that all chimneys of shops and factories, built independently, should be of a height of at least eighty feet above the street curb. But there are chimneys attached to planing-mills and the working of wood, where height alone will not entirely remedy the evil; the smoke, in particular and quiet states of the atmosphere, falls sluggishly down instead of rising, and at all times the blacks or soot is distributed earthward, in a circuit more or less extended, depending on the height of the chimney and the strength of the winds. This same nuisance obtains where soft coal is used for fuel, and it has been made often a subject of English parliamentary inquiry, how the smoke-nuisance could be abated. And it has been unanimously reported that it would be no hardship to the manufacturer that laws should be enacted by which he is required to make no smoke. There have been various patents for the burning of smoke, still the English laws prescribe no particular form, but that no smoke should be permitted to issue from the chimney. If the manufacturer provides some means of burning smoke which are efficient, and there is still smoke, the stoker is fined. If soft-coal smoke can be got rid of, that from shavings and chips certainly can be. If one watches the chimney of a planing-mill, he will observe that the smoke is variable in quantity, sometimes almost nothing, sometimes dense. The smoke is a product of imperfect combustion, too little oxygen for the carbon. It would seem proper, therefore, that there should be some general order of the Board, "that all maufactories or workshops, making use of soft coal or wood, should so conduct the firing that no smoke, in amount to be offensive, should be produced."[*]

[*] An English civil engineer says: "I have examined every class of furnace, and the kind of fuel used, with the various systems of furnace management, but I have seen no furnace, whether in iron,

There is another source of complaint for workshops, and all places where engines and boilers are used, from the exhaust-steam and from blowing off. There is a city regulation that the exhaust shall not discharge into the street-sewers. From inquiries made of parties particularly conversant with sewers, I cannot find that any detriment ever resulted to a sewer from the exhausting of steam into it. The objection was that the sewers could not be entered for examination, and that when the outlet for the steam into the street sewer was opposite the outlet of the sewer-pipe of other premises, the water was blown from the traps of these latter premises, and sewer-gases escaped thereby. The same objection was made when the blow-off from boilers are in like position. This is readily remedied. Neither exhaust nor blow-off should enter the sewer at right angles, but acutely, and in the same direction as the current flowing in the sewer, rather assisting the discharge of sewer and branches than checking it. The objection to exhausting steam into the air is the nuisance from the showers of condensed steam, which fall either as mist or rain, according to the size of the engine or temperature of air; and sometimes in buckets and barrelfuls, when the condensed water has accumulated in the exhaust-pipe, and is thrown suddenly out by the back-pressure steam as if by a pump. On this account, that these showers may interfere as little as possible with the passers-by in the street, or the yards of premises adjoining, the exhaust-pipe should be brought through the roof, near the centre of the building, with a cap over the pipe as shown in Fig. 12, by which the water condensed in the pipe may be thrown down on the roof, and carried away by the leader, instead of up into the air. But, were the old custom of exhausting into the sewer again adopted, with some provision for a temporary exhaust into the air, when necessary to enter the

Fig. 11.



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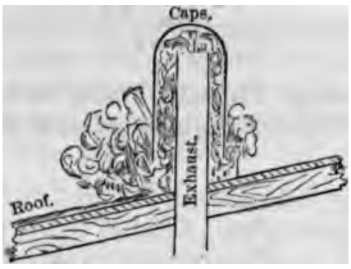
chemical, or any other works, that might not easily be made to consume its own smoke, as required by the Smoke Act. There are in London over twelve thousand furnaces of various classes, in a large number of which nothing but common dust-coal is now used. You may take your stand upon London Bridge, or ascend the Monument, from where you can scan for a distance of twelve miles, it would be difficult to trace one smoky chimney. The best of appliances are in use, but they were ineffectual for a long period, until the stokers were made to understand that they must give proper attention to their furnaces, or they would be subjected to a fine or a month's imprisonment. If it could be clearly proved by the smoke inspector before a magistrate that the furnace is fitted so that it is capable of consuming ts smoke, the prosecution then falls on the stoker for misusage."

sewers for examination, there would be less offence to outsiders, and often some gain of power to parties making use of engines.

There are some departments of industry, as solder-making, brass-founding, and the like, where, if the works are in the lower part of a building, the upper occupants complain of fumes or dust, and sometimes parties in premises adjoining. These matters of offence could be, and in other cities have been, in a great measure, prevented by more perfect arrangements, but most of the works here complained of are of very temporary construction, on leased property, where the changes would be of too extensive a kind to be undertaken by the lessee. No plans of construction have been indorsed in this department, but the form of order from the Attorney has been to so conduct the business that no offence may result to premises adjoining.

FIG. 12.



The reports on flushing the streets of New York by sea-water, made to your Board from this department, will be found in a separate appendix, and one on the Ventilation of Public Buildings, as an annex to the report of Dr. Stiles on this subject.

Respectfully submitted:

W. E. WORTHEN.

Engineer Metropolitan Board of Health.

"E."

Report on the Sources of Unhealthfulness in Crowded Assemblies and Places of Popular Amusement and Resort in the Metropolitan District.

THE evil influences by which health is destroyed are for the most part gradual and cumulative in their action. Although Nature guards life with many beneficent resources and marvellous recuperative powers, when her every effort is thwarted a sound constitution is compelled to succumb. It is only when every opportunity for a rebound of the system from the influence of depressing agencies is cut off, that this result becomes inevitable. The effects upon the human system of breathing a vitiated atmosphere afford a good illustration of these truths. Where, for example, a laborer works during the day in the open air, he may pass the night in a dark closet in a tenement-house, or in a close and crowded shanty, and escape comparatively unharmed; or a workman may work by day in the mephitic atmosphere of a factory; or a child pass many hours in a close school-room, and, sleeping by night in a well-ventilated chamber, the system will throw off the evil influence of the day's unnatural exposure. But when an individual is steadily and unremittingly immersed in a vitiated air, life is poisoned at the very source and spring of vital activity, and it is not in the nature of a living being to endure such conditions. It is true that it is at night, and in sleeping-apartments, that the system receives its greatest detriment from impure air, for it is then—as has been recently shown*—that the blood stores up a superabundance of oxygen for the day's consumption, and hence the manifest beneficence of the work of the Board of Health in opening dark bedrooms to the air and light, and placing ventilators in the halls with which they are made to communicate; but sources of disease are so rife, and to such an extent beyond control, that no place of public resort under the eye of sanitary authority ought to be allowed to add its vitiated atmosphere to other causes of depression and danger.

The sources of unhealthfulness in crowded rooms are mainly three:

1. Carbonic-acid gas derived from respiration, or combustion, or from both combined, or from defective heating apparatus.

2. Products of imperfect combustion, either from the human body, or from sources of light and heat, and organic matter in the form of floating particles in the respired air.

3. Extremes of heat and cold.

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* Pettenkoffer.

First.—The deeper the resemblance between life and the flame of a candle or taper is investigated, the closer appears the likeness between them. As the candle, touched by the mysterious forces of heat, gives rise to a flame which, maintaining its bright nature at the expense of the dull, unctuous mass, unites the carbon and hydrogen of the latter with the oxygen of the atmosphere, so organic matter, touched by the life-giving hand of Omnipotence, forms a living being which maintains its wondrous powers through a similar union of the elements of the body and of the respired air. In both, carbonic acid is the result of the chemical affinities brought into play, accompanied with products of imperfect combustion. In both, atmospheric air is an imperative condition of existence, and both dwindle and die as their supply of oxygen becomes exhausted. But, to a living being, the presence of the carbonic acid, generated by vital action, is a source of disease and death. An animal will die in an atmosphere in which a taper will burn brilliantly from superabundance of oxygen, if carbonic acid exists in it in any large quantity. If human blood be agitated with a mixture of oxygen and carbonic acid, it is the carbonic acid that will be absorbed, and not the oxygen. The former is so much more soluble in the blood that it preoccupies that vital fluid, preventing the access of oxygen in sufficient amount to support life. Hence, the very processes of life contain the germs of death, carbonic acid becoming a source of danger against which sanitary science must afford protection. Sanitary science teaches, moreover, that the greatest danger from the presence of carbonic acid does not consist in its immediate suffocating and poisonous influence when existing in large quantities in the air, but that an amount which is scarcely perceptible to the senses is sufficient to generate disease, to lower the vital forces, and destroy the zest and enjoyment of life, through constant suffering and depression.

Composition of the Atmosphere.—Atmospheric air consists of 79.05 volumes of nitrogen, and 20.95 volumes of oxygen in every one hundred parts. The normal quantity of carbonic acid is very small, but, small as it is, the forests of the world have been mainly formed from it, and its cumulative effect upon the human organism may be of proportionate magnitude. It is well known that, at a geological period when the carbonic acid of our coal-formations existed in the atmosphere, the earth was inhabited by reptilian monsters and creatures of a low organization in comparison with the living beings which now people the earth. According to the classical researches of De Saussure, carbonic acid exists in an average amount of four parts in ten thousand of atmospheric air. The air of the most diverse localities has been examined by numerous observers without detecting any other than very slight variations in this proportion. There is a slight increase on mountain elevations and in the air of cities, but the average is from four to five parts in ten thousand.

Carbonic Acid produced by Respiration.—The amount of air introduced into the lungs with each inspiration differs with the age and development of the individual, and the average amount is differently estimated by different observers. Borelli estimated it at fifteen cubic inches; Goodwin and Davy at from sixteen to seventeen cubic inches; while Dalton, Vierordt, and Valentin, rated it as high as from thirty to forty cubic inches. We may take the average of a person of medium stature to be twenty cubic inches, and the number of inspirations per minute at Hutchinson's estimate of twenty, which will give 24,000 cubic inches, or nearly 14 cubic feet of air breathed by a single person in an hour, or 336 cubic feet in twenty-four hours. Every hundred persons would vitiate, in three hours, 4,200 cubic feet of air to the extent of 4.3 per cent. of carbonic acid, or 18,000 cubic feet to the injurious proportion of 1 per cent. of carbonic acid. At every breath 4.3 per cent. of carbonic acid are given out, and 5.4 per cent. of oxygen disappear, so that every person will produce 1.032 cubic inches, or $\frac{3}{5}$ of a cubic foot of carbonic acid, in an hour. From these data the degree of vitiation—from this source—of the air of a crowded but ill-ventilated hall can be readily estimated.

But carbonic acid is not the sole dangerous product of respiration. Angus Smith found that while two per cent. of carbonic acid liberated in the air by chemical agencies could be endured, one per cent. produced by respiration could scarcely be tolerated. This is due, not only to the corresponding loss of oxygen in respiration, but to the presence of volatile organic substances in the breath, which have a decided prostrating and poisonous effect, as witnessed in the production of low fevers by exposure to their concentrated action.

Carbonic Acid produced by Illumination.—The brilliant illumination of places of public resort, which renders them attractive, is not secured without a deterioration of the air by the production of carbonic acid, and a corresponding consumption of oxygen. Each lighted gas-jet is estimated to produce five times as much carbonic acid as a human being expires in a given time. Accurate experiments have been made to determine the degree of vitiation of the air by different kinds of illumination. In a room of the capacity of 2,540 cubic feet, four cubic feet of coal-gas, burned in forty-eight minutes, and giving an illumination equal to that of ten and a half candles, have been found to increase the proportion of carbonic acid from 0.6 parts per thousand to 1.45 per thousand. These results are an average of six experiments under identical conditions. Eight cubic feet consumed in one hour and fifty minutes were found to raise the proportion of carbonic acid from 0.49 parts per thousand to 2.3 parts per thousand. Thus a single burner produced over 2.45 cubic feet of carbonic acid in an hour,* this amount remaining in the chamber, although natural ventilation was constantly lowering its proportion.

At the same time that carbonic acid is produced by the combustion of illuminating substances, other chemical combinations are formed from imperfect combustion, just as in respiration; but of both of these the carbonic acid may be taken as the measure, and the entire vitiation of the atmosphere be estimated from the presence of this ingredient.

Carbonic Acid from Heating Apparatus.—Any form of heating apparatus by which the products of the combustion of fuel are admitted into the air of a building is a serious source of unhealthfulness, not only on account of the carbonic acid introduced, but on account of the more dangerous products of imperfect combustion, of which carbonic oxide is chief. The rusting of a pipe in the air-chamber of a furnace has been known to poison seriously all who were exposed to the noxious vapors which escape from the hot-air flues. A brazier of coals lighted for the express purpose of self-destruction would not be better calculated to destroy life than such an accidental occurrence. The gas which burns with a blue flame on the surface of coal is carbonic oxide. It is generated whenever fresh coal is placed upon a fire, and until the whole mass is ignited. When the door of a stove or furnace is opened, a slight explosion is heard, and a blue flame plays over the black surface of fresh coal. While the door was shut, carbonic oxide was abundantly generated, and a closed damper or imperfect draught was, perhaps, turning this subtle poison into the air to be breathed. It attacks the red particles of the blood, and its prostrating effect is experienced long after the occurrence of exposure.

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* See Gorup-Besanez, Journal of Franklin Institute, 1869.

Thus breathing, lighting, and warming, are all attended with products which expose life and health to danger, and often all three join their deleterious agencies to assault the health of large numbers, careless and unsuspicious of danger, suffering, but not knowing where to look for the cause of their discomfort. With these facts well known, iterated by sanitarians till the ears of many hearers are weary, public and private buildings are still constructed with but subordinate reference to ventilation. Architecture had reached its full development four hundred years ago; it was the creation of chemistry at the beginning of the present century which first taught the need of ventilation; but architecture and hygiene have not wrought together so as to thoroughly harmonize the demands of both.

Methods employed in the Determination of the Amount of Carbonic Acid in the Air.—There are three principal methods by which the amount of carbonic acid in a given quantity of air is determined:

1. The method of Brunner.
2. The method of Regnault and of Bunsen.
3. The method of De Saussure and of Pettenkoffer.

1. By Brunner's method the air to be examined is first dried by passing it through a tube filled with chloride of calcium, or with fragments of pumice-stone soaked in sulphuric acid, and then passed through a second tube filled with fragments of caustic potash. The increase in weight of the second tube gives the amount of carbonic acid in the quantity of air transmitted through it.

2. The method of Regnault and of Bunsen consists in transferring the air to be analyzed to a graduated tube over mercury, and absorbing the carbonic acid by the introduction of a solution of caustic potash, the diminution in the volume of the air being measured at the level of the mercury on the graduated tube. A convenient apparatus for this method of analysis, which I have used in physiological researches, consists of a tube between two and three feet long, and a mercury-bath with a deep well attached. The tube is filled with mercury, and inverted over the bath while the air is transferred to it. The tube is then sunk in the well until it acquires the temperature of the mercury, when the volume of the air is read off on the graduated scale. A definite quantity of a solution of caustic potash is then introduced, and the volume of the carbonic acid absorbed is read off as before, after reimmersion in the mercury has made the temperature of the tube identical with that of the former reading.

3. In the method of Pettenkoffer the air is introduced into a glass globe,

together with a solution of caustic baryta of definite strength. The alkalinity of the baryta solution is diminished in proportion to the amount of carbonate of baryta formed, and will be neutralized by a proportionally less quantity of a given solution of oxalic acid, thus furnishing the elements of an accurate calculation of the amount of carbonic acid in the air of the globe. Pettenkoffer's method is superior to those in which the carbonic acid is determined by weighing the amount of carbonate formed (as in De Saussure's plan), as the danger of absorption of carbonic acid from the atmosphere in the process of filtering and drying the precipitate for the balance is here avoided.

Method of Analysis adopted.—Other and more important official duties demanded that the method of analysis adopted should be easy of execution, and it is proper to state that, in the following researches, practical utility was consulted rather than the refinements of delicate scientific research. I, therefore, at first made use of the method of Regnault and Bunsen. That of Brunner requires a greater quantity of air than could be conveniently collected in the midst of a crowded audience; that of Pettenkoffer demands the patience and training of the laboratory. But Regnault's method was found inadequate. The quantities of carbonic acid were too small to be accurately indicated on the graduated tube. I, therefore, devised the following modification of this process:

The apparatus consists of a wide-mouthed glass flask, holding 150 cubic centimetres when the cork is inserted, which is made to fit closely, and is perforated by a glass tube. The tube rising from the mouth of the flask is bent at an acute angle, and descends by the side of the flask. It is graduated so that each division of its descending portion holds one ten-thousandth part of the capacity of the apparatus. A delicate glass ball, holding a cubic centimetre of a solution of caustic potash, is introduced into the flask after the air to be analyzed has been transferred to it, and the whole apparatus is sunk in water at the temperature of the room in which the experiment is made. When the apparatus has remained so long immersed that there is no longer an increase in the volume of the contained air from elevation of temperature, the flask is lifted from the water, the bulb is broken by a smart tap on the side of the flask, and it is at once reimmersed in the water. According to the amount of carbonic acid in the air of the flask, and the strength of the solution of caustic potash, the water rises either quickly or slowly in the tube, and rises in just such quantity as the carbonic acid is absorbed, which is read on the graduated scale attached to the tube. Experience has shown that certain precautions are necessary to secure accurate results, but the method is simple and easy of employment, not longer than fifteen minutes being required for each analysis.

It is desirable to have the apparatus and contained air at a slightly lower temperature than that of the room and of the water-bath before the first immersion, in order that the graduated tube may be empty for the rise of the water when the bulb is broken. The water-bath ought to be at the temperature of the room; for, short as is the period of time required to withdraw the apparatus and break the bulb, it would still be long enough to change the volume of the air in the flask if there were much difference of temperature in the two media.

The water in the water-bath must be agitated from time to time during the first immersion, so that the flask may not find on reimmersion a different stratum and a different temperature, however slight.

The flask must not be touched with the hand, as its heat is at once communicated, increasing the volume of the air in the flask.

The flask should contain a few drops of water before the first immersion.

Before employing this method for purposes of analysis of the air of public buildings its accuracy was tested in several ways. When a specimen of vitiated air was diluted with an equal quantity of pure air, or was mingled with twice or three times its volume of the same, the analysis would give the proper proportion of carbonic acid for each dilution. Air deprived of its carbonic acid by caustic potash showed no absorption under analysis, while the atmosphere of the city yielded varying proportions up to one part in a thousand, the smallest amount being present during storms of wind and rain, when 0.2 parts in one thousand were indicated. Where larger quantities of air can be readily procured for purposes of analysis, the whole apparatus may be of greater size, and the greatest accuracy can be obtained.

Buildings examined.—Schools, theatres, halls, churches, court-rooms, hospitals, etc., were examined, but the first two occupied most attention. Those who would not be shocked if theatres were tenfold more mephitic than they are would demand that our schools should not add one avoidable source of unhealthfulness to the necessary evils of bodily confinement and restraint, and of forced and straitened intellectual activity. I had myself watched a patient, a child failing in strength, and falling into ill-health, whom I traced to a back-parlor, where, with forty others, he was daily exposed to the worst evils of want of ventilation; and I learned of other instances in which teachers of excellent reputation had altogether overlooked or undervalued the fundamental requirements of a wholesome medium for the development of the mental powers of their pupils. It was not designed that these investigations should be made to yield no practical result in the correction of the evils they disclosed. It was planned that, on the report of inadequate ventilation in any place of public resort, the rooms should be examined by the Engineer of the Board of Health, and the simplest method of adequate ventilation in each instance having been recommended, that the Board should require the correction of the evil. Time will determine whether this plan of action can be carried out; but much good may be anticipated by simply calling public attention to the subject.

Schools.—A number of analyses are on record, by thoroughly competent observers, of the air of school-rooms. The following are taken from Wetherell's report on the "Ventilation of the Capitol," which is stored with valuable material for the study of the subject in question:

OBSERVER.	Locality.	Carbonic Acid, parts in 10,000.	Times the normal amount.
Wetherell	A public school in Washington.	9.45	3.5
Wetherell	A public school, another part of the room	10.57	3.9
Wetherell	A public school, another part of the room	9.32	3.5
Wetherell	Mrs. Rodier's school	17.18	5.3
Leblanc	School in Paris	30.74	7.7
Leblanc	School in Paris	56.90	14.2
Pettenkoffer	School in Germany	45.72	16.0
Roscoe	School in England	23.71	6.4
Roscoe	School in England	31.90	8.4
Roscoe	School in England	32.53	8.8
Roscoe	School in England	24.59	6.6
Roscoe	School in England	29.49	8.0

The following researches by W. Trechsel, of Berne, in the air of school-rooms, are taken from the *Manufacturer and Builder*, for January, 1869 :

Carbonic Acid in 10,000 vols. of air.

1.—Thirty-four boys from 6 to 7 years; one teacher. Space, 106 cubic metres;* temperature, 81.1° Fahr., . . . 35.22 vols.

2.—Thirty-nine boys of 8½ years; one teacher. Space, the same; temperature, 83.3 Fahr., ... 29.69 vols.

3.—Twenty-six boys of 10 years; one teacher. Space, 97.15 cubic metres; temperature, 77° Fahr., ... 21.78 vols.

4.—Twenty-three boys of 10 years; one teacher. Space, 97.73 cubic metres; temperature, 75.1° Fahr., . . . 19.83 vols.

(This result is only placed here for the sake of completeness, as a small ventilator was open during the recitation.)

5.—Twenty-five boys of 11 years; one teacher. Space, 214.5 cubic metres; temperature, 71.6° Fahr., ... 33.03 vols.

There had been singing in the room during the hour previous to this experiment. After the boys had left the school-room, whereby the door was kept open for a few minutes, the amount of carbonic acid had decreased to . . . . 15.89 vols.

6.—Twenty-two boys of 12 years, singing in the close room for forty minutes; air examined at the end of thirty minutes.
Temperature, 73.4° Fahr., ... 26.10 vols.
Calculated at fifty minutes, ... 32.05 vols.

7.—Fourteen boys of 15 years. Space, 114.45 cubic metres; temperature, 73.4° Fahr., ... 18.54 vols.

8.—Twenty-one boys of 15 years. Space, 100.49 cubic metres; temperature, 78.8° Fahr., ... 21.31 vols.

9.—Sixteen pupils of 17–19 years. Space, 104.14 cubic metres; temperature, 77.9° Fahr., ... 19.70 vols.

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* A cubic metre equals 1.3 cubic yards.

10.—Thirty girls of 8 years. Space, 95.13 cubic metres; temperature, 82.4 Fahr. (!), ... 23.98 vols.
11.—Thirty-three girls of 9 years. Space, 122.5 cubic metres; temperature, 79.7° Fahr., ... 22.86 vols.
12.—Forty-one girls of 12, and eight of 15 years. Space, 220.6 cubic metres; temperature, 73.4° Fahr., . . . 27.58 vols.
13.—Eleven girls of about 15 years. Space, 81.9 cubic metres; temperature, 73.4° Fahr., ... 20.37 vols.

"It may be observed that, in the determination of the cubical contents of the rooms, the space occupied by the large furnaces was measured, and deducted from them. No account, however, was taken of the space occupied by the furniture and the individuals themselves. In regard to the stratum of air used in making the above experiments, it may be remarked that it was almost always taken at the height of the school-room desks. Comparative determinations between different strata of the same room have not as yet been undertaken.

"The above experiments give room for the following conclusions: They show at the first glance that the amount of carbonic acid in the air of the school-room may reach sixfold that of the exterior atmosphere when under the less favorable conditions of city localities. When we consider that, together with the said gas and the watery vapor accompanying it, many other volatile substances are given off from the surface of the body, the relative amount of which so accumulates that the quantity of carbonic acid present can only give us an approximate idea of the total amount of accumulation, we can conceive how rapidly the respirability of the air must decrease, and how soon it must become unfit for the support of the various physiological functions of the human organism. In fact, one entering such a room is at once seized with a feeling of oppression, which only gradually disappears after a certain adaptation to the existing conditions of the room has taken place."

The following are the results obtained in schools of Brooklyn, by the method of analysis I have described:

SCHOOLS.	Carbonic Acid, parts in 1,000.	Times the normal amount.
Public School, No. 1	1.	2.
Public School, No. 1, another room	1.5	3.
Public School, No. 15, Tenth Ward	2.	4.
Public School, No. 15, another room	4.	8.
Clarke's Commercial College, 16 Court Street.	2.4	5.
Clarke's Commercial College, another portion of room	.5	1.
Clarke's Commercial College, class-room	.75	1.5
College Grammar School, 18 Court Street	2.	4.0
College Grammar School, another portion of room	.8	1.6
College Grammar School, another portion of room	1.33	2.7
College Grammar School, class-room	.66	1.3
Polytechnic Institute, third story	1.11	2.2
Polytechnic Institute, class-room	.5	1.
Polytechnic Institute, second story	.66	1.3
Public School, No. 13, Degraw Street	3.1	6.
Public School, No. 13, another room	2.5	5.
Public School, No. 13, another room	1.66	3.3
Public School, No. 27	2.7	5.4
Public School, No. 27, another room	2.2	4.4
Public School, No. 27, another room	1.2	2.4
Public School, No. 29	1.6	3.2
Public School, No. 29, another room	2.2	4.4
Public School, No. 29, another room	1.4	2.8

In all these cases the design was to find the air at its greatest degree of impurity, or after the rooms had been occupied for several hours.

The public schools of Brooklyn are mainly built on the same model, and are warmed and ventilated on the same principles; so that the examination of a few will furnish an estimate of the excellences and defects of all. Our inspection of No. 1, in Concord Street, gave a very favorable impression. There were 800 children present, 900 being on the rolls. The day was fine, and the windows were lowered in every compartment. The thermometer stood at about 70° Fahr. in every room but one, in which it was as high as 74°, and in only one room was there any taint of impurity of the air noticed. Air was taken from those rooms or compartments in which it seemed most probable that carbonic acid would be found most abundantly; but one or 1.5 parts in one thousand were the highest proportions. The heated air streamed abundantly into the rooms from air-chambers containing coils, which last were heated by a separate boiler for each floor, and escaped through a ventilator in each room, not far from the floor, through which it passed with sufficient force to draw in a light handkerchief held in front of the opening. The scholars are at school from 9 A. M. to 3 P. M., with an hour and half of recess or intermission. The general impression was one of enlightened design and management. As we were in search of results only, we did not enter into details respecting the capacity of the rooms, nor the measurement of the size of the inlets and outlets of air, nor its velocity of motion, which ought to be taken into consideration, however, in the architectural arrangements of every public building.

In Public School No. 15, Tenth Ward, it was found that a basement which had been designed for a play-room had been required by the pressure of applications to be made to do service by dividing it into school-rooms. In a room 20 feet by 20 feet, and 10 feet high, in which were 114 boys, air taken at noon gave two parts of carbonic acid per 1,000; another room, 20 feet by 12 feet, with seventy-nine scholars, gave four parts per 1,000. A room designed as a cloak-room, and of correspondingly restricted dimensions, contained forty of the smallest children. A lowered window was its only ventilator. That one of these rooms should have contained eight times the proper amount of carbonic acid was evidence that they were unsuited to the purpose which they were made to serve.

Public School No. 13, in Degraw Street, was inspected on a cold and cloudy day, when all its windows were closed, and at the hour of 10.30 A. M., when its rooms had been occupied for nearly two hours. In one of the side compartments, on the first floor, containing fifty scholars, the thermometer was found at 75° Fahr., and the air contained 3.1 parts carbonic acid per 1,000. In the infant class-room, the last room on this floor, the air taken from the platform contained 2.5 parts carbonic acid per 1,000. In the class-room on the third floor, the ventilator was found obstructed by the dresses of the pupils, who sat against it, but there were only 1.66 parts carbonic acid in the air, probably because, very properly, the air had been renovated in the absence of the classes, by open windows. In one of the compartments on the west side, on on the third floor, 2.7 parts of carbonic acid were found. In all the rooms heated air was found rushing abundantly, but the ventilators were acting with varying degrees of efficiency.

Public School No. 27 was inspected on a bright, cold day. All the ventilators showing a good draught. A class-room for small children, on the first floor, under the stairs, gave 2.2 parts per 1,000. Two of the side compartments, containing about seventy-five scholars each, gave 1.2 and 1.6 parts respectively.

Public School No. 29. The upper floor of this building, the ceilings of which were low, was not examined, as we found it empty for a temporary recess, but two of the rooms on the first floor, with windows slightly lowered, were found to contain 2.2 and 1.4 parts of carbonic acid respectively.

It is thus shown that in one building only, and under exceptional circumstances, the amount of carbonic acid was found as high as eight times its normal amount of half a part in 1,000. The proportions given were those obtained after from two to four hours of occupancy. The principles of heating and ventilation are good, but it is a difficult problem to keep the air of crowded apartments pure in our winter season. In all the schools the heat was found abundant, so that a more powerful draught in the ventilators and openings of greater area might be introduced with advantage. But, with the present arrangements, the purity and proper temperature of the air will depend greatly upon the watchfulness of the teachers, who should always bear the above fact in mind. There are but few days when the windows may not be slightly lowered from the top without creating currents, which would endanger the health of the children, but changes in the outside temperature, in the direction and force of the wind, and consequently in the supply of heat from the boilers, and in the working of the ventilators, require corresponding accommodations, which only attentive supervision can properly regulate. Every room ought to contain a thermometer, as sensations of heat and cold are very fallacious.

Clarke's Commercial College occupies the upper stories of Nos. 12, 14, and 16 Court Street. It consists of one large hall, divided into two nearly equal portions by an alcove, and of several smaller rooms for recitations. There are ventilators in the ceiling of the principal hall, but the hall is heated by the radiant heat of steam-coils, so that there is the closeness inseparable from this mode of warming in the absence of ventilators communicating with a strong draught. The half only of the large hall was occupied, but air collected in a corner farthest from the alcove, and near the heating apparatus, gave 2.4 parts per thousand of carbonic acid, while the air in the middle of the unoccupied portion gave only .75 parts of carbonic acid. This result was a matter of surprise as indicating that natural ventilation, or the diffusion of gases in air perfectly free from circulation is not to be depended upon to keep the atmosphere of a room in a wholesome condition. The indications of this inspection and of the subsequent analyses were, that carbonic acid clings to a warm, moist, still air with considerable tenacity. Fearful lest an error of analysis might have presented false indications, I examined more closely into the subject, and found that, when the different portions of a room were at different temperatures, the greater proportion of carbonic acid was most frequently found in the warmest localities. An attraction of moisture for carbonic acid would aid in placing this food of plants more readily at their disposal; and, as it must be drawn from the air which surrounds the plant, such a provision would seem necessary. May it not be that the increased capacity and attraction of heated air for moisture may be attended by a corresponding increase of attraction for carbonic acid, and that a warm stratum of air will retain certain proportions of this gas in contact with another cooler stratum containing much smaller proportions? Air taken from near the ceiling was always found more highly charged with carbonic acid than that in the lower portions of a room, and the difference was often very marked. I am led, therefore, to believe that the analysis which gave 2.4 parts carbonic acid per 1,000 to the occupied portion of the hall in this case, and only .75 to the unoccupied division, indicates rather a sluggishness in the diffusion of small amounts of carbonic acid rather than an error in the investigation. A class-room containing but a few pupils gave 0.5 parts carbonic acid per 1,000.

The College Grammar School occupies the upper story of No. 18 Court Street. The ceilings are low and there were no ventilators in the room, which was heated by a stove; but the room extends across the building with windows at both ends. Standing on the raised platform at one end of the hall, and collecting air within a foot of the ceiling, it gave 2.0 parts carbonic acid per 1,000, while that collected in other parts of the room gave 1.33 and 0.8 respectively. The want of the circulation in the air of the hall was manifested by this difference in its constitution in different localities. A class-room with open door, and but a few occupants, gave 0.66 parts per 1,000.

In the Polytechnic Institute the proportions found, viz., 1.11, 0.66, and 0.5 parts per 1,000, were found immediately after the close of the day's session: the first in the large hall in the third story over the chapel; the second in the corresponding hall in the second story; and the third in a class-room.

In the first of these institutions, the Commercial College, the mode of heating ought to be changed, as, with the main hall filled, the atmosphere would be very impure. In the second, the College Grammar School, ventilators should be introduced.

But it is in the private schools in ordinary dwelling-houses, where no provision exists for the accommodation of large numbers of pupils, that an investigation would reveal the most unwholesome conditions, and such an investigation will probably be demanded.

Theatres.—The following analyses of the air of theatres have the credit which belongs to the distinguished experimenters against whose names they are recorded:

OBSERVER.	Locality.	Carbonic acid in 10,000 parts.	Times the normal proportion.
Leblanc	Opera Comique, parterre	15.04	3.7
Leblanc	Opera Comique, gallery	28.12	7.0
Loppens	Theatre in Ghent, parterre	46.3	9.3
Loppens	Theatre in Ghent, gallery	53.6	10.7
Roscoe	Theatre in England, parterre	24.8	7.1
Roscoe	Theatre in England, gallery.	30.4	8.7
Angus Smith	Theatre in England, parterre	40.	8.

Dr. Letheby is authority for the following averages, as reported in the *Chemical News*, for January, 1868:

	Carbonic acid in 10,000 parts.	Times the normal proportion.
Theatres in London	14.9	3.7
Theatres in Manchester	14.8	3.7
Theatres in Paris	33.	8.2

The theatres examined in the course of these investigations were, in Brooklyn, as follows:

LOCALITY.	Carbonic acid in 1,000 parts.	Times normal amount.
Academy of Music	1.6	3.2
Academy of Music, gallery	1.	2.
Academy of Music, gallery	2.5	5.
Park Theatre, gallery	1.4	2.8
Olympic Theatre, gallery	3.6	7.2
Hooley's, gallery	3.2	6.4

In New York the following results were obtained:

	Carbonic acid in 1,000 parts.	Times normal amount.
Booth's Theatre, parterre..................	1.	2.
Booth's Theatre, parterre..................	0.75	1.5
French Opera, Fourteenth Street, parterre....	2.	4.
Wood's Museum, parterre..................	0.6	1.2
Tammany Theatre, parterre................	3.1	6.2
Bowery Theatre, parterre..................	7.6	15.2
Bowery Theatre, parterre..................	6.1	12.2
Bowery Theatre, parterre..................	2.5	5.

The Academy of Music in Brooklyn is not deficient in ventilation. The hot air which warms the building enters by two registers, one in each aisle of the parterre, and ascending escapes by a large circular opening in the roof into the loft, or when the traps are opened, into the external air. This ascending current creates a strong draught through every open door and window, so that the air is constantly renovated. There are also gratings over the galleries for purposes of ventilation. The draughts of cold air from the opened doors are the only ground of complaint.

On a calm, wet night, with but a moderately full house, after the doors had been closed for over an hour, 1.6 parts carbonic acid per 1,000 were found in the air of the balcony.

On an opera night when the house was crowded, the air of the upper gallery was tested. The thermometer at 9.30 P. M. marked 77° Fahr., and so remained till the close of the performance, and the air contained 2.5 parts carbonic acid per 1,000.

The air of the same gallery at the close of a concert, with a full house, was found to contain 1 part carbonic acid per 1,000.

In the gallery of the *Park Theatre*, with a moderately full house, at 9 P. M., 1.4 parts carbonic acid per 1,000 were found.

In the gallery of the *Olympic*, at 9.30 the same evening, 3.6 parts carbonic acid were found, although the house was by no means crowded.

At *Hooley's*, at ten o'clock of the same evening, with a full house, the air of the gallery, near the door, contained 3.2 parts of carbonic acid per 1,000.

For the purpose of studying the ventilation of the New York Theatres, places were taken in advance, as near as possible to the centre of the parterre in each theatre, that the conditions might be nearly the same in each. Were any particular theatre the subject of special inspection, in view of an order of the Board of Health for the improvement of its ventilation, it would be necessary to take specimens of air in different parts of the house, but, for purposes of general comparison, one locality was deemed sufficient. With this precaution respecting locality in all, the attendance was very different, and the weather so variable as to vitiate an accurate comparison.

At Booth's Theatre, when crowded, two portions of air taken at different but late periods of the evening, gave 1. and 0.75 parts per 1,000 of carbonic acid respectively.

At the French Opera, when crowded, the thermometer marking 78° Fahr., air taken at 9.30 P. M. contained 1.3 parts of carbonic acid, and at the close of the opera 2 parts per 1,000.

At Wood's Theatre, with a slim attendance, 0.6 parts per 1,000 were found, the thermometer not rising higher than 70½° Fahr.

At the Tammany, the temperature not rising higher than 71½° Fahr., 3.1 parts carbonic acid per 1,000 were found.

At the Bowery Theatre, on a close, rainy night, the house being densely packed, and the thermometer ranging from 80° to 90° Fahr., three portions of air, taken at different periods after the close of the first act, contained 7.6, 6.1, and, after doors had been opened for ventilation, 2.5 parts per 1,000.

The analyses of air taken from the Tammany and Bowery Theatres are suspicious from the large amount of carbonic acid indicated. The former gave to the senses no evidence that its atmosphere was to such an extent impure, while the latter justified as poor an opinion of its ventilation as the three analyses warranted. Where an analysis looked suspicious, its correctness was tested on Angus Smith's plan, which consists in determining the quantity of air required to render turbid a given quantity of lime-water, or of a solution of caustic baryta, and gives sufficiently close approximations to correct any serious error. The specimens of air subjected to analysis were, with the exception of a half dozen, collected by the writer, so that the real source of the specimen, and the circumstances under which it was procured, were known with certainty.

The crowding of theatres, necessitating narrow seats and uncomfortable positions, is inconsistent with the real enjoyment of even the best play, while it renders deficient ventilation more evident and insalubrious.

Hospitals, Halls, Churches, etc.—The results recorded in the following pages indicate how inadequate in general are all the provisions for ventilation in our public buildings; but this justice must be rendered, that the endeavor was to find them at their greatest degree of vitiation of the air by respiration, an analysis having always been looked upon coldly if it failed to give evidence of the presence of carbonic acid in considerable quantity when other indications led to expect it.

A ward in the Kings County Hospital in the daytime, and but partially occupied, gave two parts carbonic acid per 1,000 of air. At night, when every bed is filled, a larger proportion would have been found.

In the "Infant Ward" of the "Almshouse," air was taken on two occasions, with the expectation that it would prove very impure on account of the odor which pervaded it, but 1.2 was the largest amount indicated. The same fact was shown here as in the nursery of the Home for Destitute Children, in Butler Street, where, from the penetrating odor which seems inseparable from infant nurseries, it was expected that a large proportion of carbonic acid would be discovered, but only 0.6 parts per 1,000 were found—an air almost as pure as the outside atmosphere. The vitiation was from organic emanations, but the ventilation was proved excellent in this part of the building. In the *dormitories* of the *Butler Street Home*, air taken at 5 A. M. by a nurse under the physician's direction, gave 1.2 parts carbonic acid per 1,000, a much more favorable result than was anticipated. Air which I collected in the boy's play-room, in the basement, gave only 0.8 parts per 1,000.

In the hall of the "Hamilton Literary Association," 16 Court Street, on the occasion of a meeting of the Kings County Medical Society, about eighty persons present, air taken within a foot of the ceiling, after three hours' occupation, gave 3.1 parts carbonic acid per 1,000, while that taken at the same time within three feet of the floor gave 1 part per 1,000.

On another and similar occasion, with one of the windows lowered, air from near the ceiling gave 2.4 parts per 1,000, and that from near the floor 2 parts per 1,000. It is here shown that the tendency of the impure air is to rise at first, but, in the absence of means of escape, it gradually cools and falls, vitiating the entire atmosphere of the room.

In the hall of the Long Island Historical Society, on the occasion of a lecture in the evening, about two hundred persons present, 1.8 parts carbonic acid were found.

In Plymouth Church, at a Saturday afternoon concert, with full attendance, air taken beneath the gallery and between the doors gave 0.6 parts per 1,000 of carbonic acid. On another occasion, one of a religious character, air taken from the body of the church and from the gallery gave 2 parts per 1,000, alike in both.

In the City Court Room, No. 24 Court House, which was crowded on the occasion of a public meeting in the evening, air taken between the doors on the floor gave 1 part per 1,000.

In the Circuit Court Room, No. 20 Court House, when crowded, air taken between the doors gave 2 parts, and taken at the side of the room, midway, 2.6 parts per 1,000.

Air taken in a crowded lager-bier saloon gave, in one part of the room, 3 parts, and, in another, 0.7 parts per 1,000.

The air of a sick-chamber, in the morning, gave 1.5 parts carbonic acid.

The air of the Brooklyn Post-Office, in which the odor of burning coal was evident, gave 1.2 parts carbonic acid per 1,000.

It will not be necessary to mention in detail the faults of all the buildings to which the above analyses belong. The fact is made evident that, where special provision for ventilation has not been made, large numbers cannot be collected without rendering the air they breathe impure. By special provision for ventilation, I do not mean merely holes broken into the wall, unconnected with ascending currents of air. Ventilation by aspiration or by connection with such currents, either established specially for purposes of ventilation, or in connection with the heating apparatus of the building, is, next to forced ventilation, in which pure warm air is forcibly thrown into the building, the best mode of renewing the air, and the former method is easily applied to halls or apartments of moderate dimensions.

The Kings County Hospital has its deficiencies clearly brought out by contrast with the neighboring Asylum and Nursery. The Asylum is provided with forced ventilation, and the Nursery with arrangements for ventilation by aspiration. All has been done in the hospital which the architectural limitations permit, such as providing gratings over doors and windows, but in spite of them the air of the wards is liable to become stagnant and impure. This, in a building of that nature, ought to be promptly corrected.

The Butler Street Home has been the object of repeated efforts, on the part of those most skilled in the business, to secure adequate ventilation, and the present plan is probably as complete as the structure of the building, inappropriate for an asylum, renders possible. Our analyses do not give unfavorable results, but the air was taken on a bright, clear day, when the ventilating apparatus had put on its best appearance.

The rooms in the building, 16 Court Street, where the Hamilton Association and Long Island Historical Society have their halls, are not well ventilated. It is their chief defect.

The churches shall be held sacred from criticism. The arrangement at the "New St. Ann's, on the Heights," is worthy of imitation. Hot coils cause an ascending current in the interior of a wide flue rising to the top of the building, to which air is drawn from every part of the structure by connecting flues, into which innumerable openings give passage to the air from the floor of the church and from the ceiling of the lecture-room below.

II. The remaining causes of unhealthfulness in places of public resort are the *products of imperfect combustion*, from sources of light and heat, and from the human body, and organic particles filling the air in the form of fine dust.

Products of imperfect combustion, from sources of light and heat, are less important, as affecting health, than those exhaled from the human body. Carbonic oxide has already been considered as causing a dangerous vitiation of the air, when derived in considerable quantity from the combustion of coal, and set free within a building by an imperfect draught. It is of great importance to determine whether this gas is ordinarily present, in recognizable quantities, in rooms heated by coal-stoves or furnaces. That it can pass through red-hot plates of iron, has been proved; but that it is a very common impurity in air heated in the manner above-mentioned has not been demonstrated, although rendered probable by the *malaise* attending the first lighting of furnace-fires on the approach of winter, and before the system has become habituated to its poisonous influence.*

Carbon and sulphur, from the imperfect combustion of gas for the purpose of illumination, have not been shown to exert an injurious influence over the system. The particles of carbon entering the lungs are thrown off by the action of the ciliated epithelium of the bronchial tubes; and sulphur, in the form of sulphurous acid, is easily recognized when it exists in as small a proportion in the air as one part in 100,000. Rooms should never be heated by gas-stoves, unless there is free escape provided for the products of combustion.

The products of imperfect combustion from the human body are, however, a source of real danger. If the skin of one of the lower animals be coated with an impervious varnish, the animal speedily perishes, as would a human being under similar conditions. Its temperature falls, its blood refuses to undergo the usual respiratory changes; the kidneys become congested; albumen appears in the urine; the nervous energies are prostrated, and death in coma or convulsions supervenes. If the breath of the healthiest person be passed through concentrated sulphuric acid, or through a solution of permanganate of potash, indications are furnished of the existence of an organic substance in the expired air. In the former case, the sulphuric acid is darkened by the carbonization of the organic matter; in the latter, the permanganate loses its rich color through the oxidation of the same.

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* See Derby, "Anthracite and Health," Boston, 1868.

The substances known to exist in the exhalations of the skin are sudoric, formic, butyric, lactic, and other organic acids, and a *protein* compound in a state of decomposition.

The average loss of weight due to both cutaneous and pulmonary exhalation is sixteen grains per minute, two ounces per hour, or three pounds in twenty-four hours. Of the daily loss, thirty ounces are due to perspiration and eighteen ounces to pulmonary exhalation. One hundred persons would therefore give off in three hours 37½ pounds of moisture, which, with its volatile ingredients, is taken up by the surrounding atmosphere, and adds to its vitiation. A few trials were made with solutions of permanganate of potash to determine the proportion of organic matter derived from the human body, which was present in the air of crowded halls. The solution of permanganate was placed in a vaporizer, and, having been brought into contact with the air of the room in a state of very fine division, the spray was collected in a test-tube and reserved for comparison with other portions of the same solution, acted on by a known quantity of organic matter. But the discoloration was not found to accord with the manifest degrees of impurity at the time and place of investigation. The permanganate solution is so unequal in its reactions with different kinds of organic matter, and, in dealing with proportions so small as those contained in human exhalations on the air of a building, accidental errors are so liable to hide the results sought for, that the method was abandoned as unreliable.

The sense of smell is a good qualitative but not quantitative test of the kind of vitiation under consideration, and it has often happened to the experimenter, in the course of these researches, to be met, on entering the crowded gallery of a theatre, by the overpowering influence of an atmosphere of between 80° and 90° Fahrenheit, loaded with such evidences of the presence of human exhalations that carbonic acid, in its pure toxic effect, seemed insignificant in the comparison. It is not surprising, therefore, that experimenters have found a deleterious influence, in an atmosphere so vitiated, out of proportion to that which follows the presence of carbonic acid liberated by chemical reactions. The very substances, whose retention in cutaneous asphyxia, or interruption of the action of the skin, is so speedily fatal, are reingested, and reënter the circulation through the lungs, when they load the respired air. The nature of these exhalations is not well understood, but most of them affect decidedly and unpleasantly the olfactive sense. *Omne ignotum pro mirifico*, they are suspected of subtile and dangerous powers of poisoning the system, and communicating disease, and make a clamorous appeal for better ventilation. They bear a certain proportion to the carbonic acid produced by respiration, and, when the latter is found in excess, the presence of excessive quantities of the former is also made evident.

The particles floating in the air and falling in the form of fine dust were subjected to patient investigation. Over one hundred specimens of dust, from nearly every place of public amusement in New York, were examined by the aid of the microscope. This dust was collected from places where it had been gradually deposited, as it would have been on plates of glass prepared to receive it. Although the localities from which it was derived were so various, its composition was quite uniform. The proportion of the various ingredients of which it was composed varied, but the same constituent particles were found in all the specimens examined. It was the dust of the streets, in its finer or coarser particles, according to the height at which it was collected, with a large proportion of organic elements. Particles of sand, of quartz and feldspar; of carbon from coal and lamp-black; fibres of wool and cotton of various tints; epidermic scales from the human body; granules of starch, of wheat mainly; the tissues of plants; the epidermic tissue recognized by the stomata, or breathing pores; vegetable ducts and fibres, recognized by their markings; vegetable hairs or down, in great variety, single, or in tufts of four or eight; three distinct kinds of pollen, found in nearly every specimen; spores and filaments of fungi in abundance. When water was added to a portion of dust, from whatever source, and exposed in a test-tube to sunlight or heat for a few hours, vibriones and bacteria made their appearance, and the fungous spores sprouted into filaments, or multiplied in cryptococcus or yeast-like germs, showing that they maintained their vitality, and demonstrating the wide diffusion of the germs of fermentation and putrefaction.

On the surface and in the gutters of the Nicholson or concrete pavement, when neglected or not flushed by rains, may at any time be seen a straw-like layer, often several inches in thickness (even when unmixed with mud or earth), composed of the excreta of horses, which, ground into fine powder under wheels and hoofs, is carried by the wind as fine dust into every, even the most secluded, corner of the city, and abounds in buildings situated on the principal thoroughfares. This same material, under the microscope, is seen to be identical with that which forms a large part of the dust taken from our places of amusement: the epidermis, ducts, and woody fibre of hay or grass, comminuted, but not destroyed; the residue of the digestion of oats, mingled with epithelium, and, doubtless also with mucus from the alimentary canal of horses—this constitutes a large proportion of the material which floats on the air we breathe, and is raised in clouds as a tribute to beauty or talent by the applause of a delighted audience. We have in these facts an argument for the daily sweeping or flushing of our principal streets, and for the utilization of street dirt as a rich fertilizer. Far better to ingest it when the radicles and ducts of plants have selected from it their food, and transformed it into succulent vegetables or juicy fruit, than to take it into the parched mouth and wheezing lungs without any elaboration.

In conclusion, it may be urged, without fear of contradiction, that there is no one subject of greater sanitary and therapeutic importance than that of ventilation. The injury which the human system receives from malaria poisoning the free air, whether from marshes or collections of decaying organic matter, whether from country or city, is insignificant in comparison with that which lurks in human habitations, whether in germs of disease, or in the wide-spread prostration and suffering which result from poisoning the breath of life. A life would be well spent if through its agency a tendency to improvement in this direction could be made manifest; and the Board of Health, with its world-wide influence, has no more important duty than in connection with this very question of ventilation, not only in tenement-houses, but in all places of human habitation and resort.

Respectfully submitted:
R. CRESSON STILES,
Assistant-Sanitary Superintendent.

ENGINEER DEPARTMENT METROPOLITAN BOARD OF HEALTH.

TO COLONEL EMMONS CLARK, *Secretary:*

Associated by the order of your honorable Board with Dr. R. C. Stiles in the investigations of the ventilation of public buildings in the cities of New York and Brooklyn, we have together and separately made examinations of the conditions and temperatures of the air, and of the means of ventilation adopted at theatres, places of amusement, schools, etc. Agreeing in our general views, it yet seemed most proper that our reports should be distinct: that Dr. Stiles should give a statement of the facts as found—the analyses of the air, the microscopic examinations of the dust floating in it, and the observed temperatures, with comparisons of the conditions of other buildings, as given by other experimenters, and also with the standards of sanitary requirements; and that the Engineer should suggest some practical means by which the ventilation might be improved.

By a perusal of the preceding report (Dr. Stiles's), it will be observed that, of all the places examined, none came fully up to the standard of sanitary necessities; that the analyses of the air give too large a percentage of carbonic-acid gas; that the dust with which the air is loaded is foul with matters offensive and poisonous; that the ranges of the thermometer are much higher than are conducive to comfort or health. The modes of ventilation were sufficiently varied in the different buildings; ventilation by fans forcing in air heated by steam-coils; ventilation by hot-air furnaces, and by stoves, but all come to the same general result; the difference is in degree; one may be better than another, but the best is bad enough. One portion of a room or building may be comfortable in temperature and healthy in the condition of its air, and another portion neither, or the whole building throughout may be ill warmed and ventilated.

Of late years much has been written on the subject of ventilation, and many different modes tried. Halls of legislation, hospitals, courts of law, etc., etc., have been ventilated by methods expensive in their construction, and in their maintenance, and very few have been perfectly satisfactory. Of the amount of air necessary for ventilation, "few subjects," says the "Encyclopædia Britannica," "present a greater diversity in practice than the amount of air given for ventilation. From two to four cubic feet per minute for each person have usually been considered a large supply, but this is far beyond the amount commonly allowed. A very slight examination, however, will show that even this amount is often too small. If the process of respiration be accurately examined, it will be observed that a cubic foot of air or more is involved or mixed and contaminated with the air discharged from the lungs at each expiration independently of that affected by the skin. According to Dr. Reid's experiments not less than ten cubic feet of air per minute should always be allowed when it is warm. At the late Houses of Parliament from 36,000 to 50,000 cubic feet per minute have occasionally been given in sultry weather in the House of Commons alone, or about sixty feet per minute to each individual in a crowded house."

Morin, in his "Manuel du Chauffage," gives a table of the volume of air to be supplied and drawn out per minute for each individual to secure salubrity:

Hospitals—ordinary sick	35 to 40	cubic feet.
" wounded, and women in confinement	60	"
" in times of epidemic	90	"
Prisons	30	"
Workshops—ordinary trades	35	"
" unhealthy trades	60	"
Theatres	25 to 30	"
Schools for children	7 to 9	"
" " youth	15 to 17	"
Stables	105 to 118	"

The amount of air taken into and expired from the lungs, according to preceding report of Dr. Stiles, may be taken at fourteen cubic feet per hour, or less than one-quarter of a cubic foot per minute; "eighteen grains per minute are given by the lungs and skin together in water containing ascetic, formic, sudoric, and butyric acid, chloride of sodium, and urea; of these eighteen grains, seven are from the lungs, and eleven are from the skin."

It will be seen that, to ventilate a single individual, to supply him with fresh air for every breath, and to carry off that contaminated by personal emanation, a very small volume of air only is requisite; but when many persons are collected together, and the emanations from lungs and skin are mixed with the air, and breathed over and over again in greater or less percentage, that very large volumes of air must be introduced and withdrawn to neutralize the effects of this vitiation, and the greater the number of people, the greater the volume necessary for each individual, and the less the certainty of securing sanitary ventilation.

Sir J. T. Simpson has lately called attention to an alleged very high rate of mortality in hospitals after surgical operations, as compared with the mortality after the same operations when performed at the homes of the patients. Sir James further asserts that the mortality after operations performed in hospitals containing more than three hundred beds is greatly in excess of that in hospitals containing less than three hundred beds; that great hospitals are great evils in exact proportion to their magnitude.

All systems of ventilation are on the same basis of providing large volumes of fresh air for the dilution of the vitiated air, and for the contingencies of unequal distribution; yet, with all this provision, in the very best-constructed hospitals, theatres, schools, etc., there are always dead ends or corners, where the air circulates very sluggishly, and where its offensiveness is readily detected by the nose. It is claimed that gases are uniformly diffused; if so, a very long time seems requisite to effect it.

In hospital wards, there are often beds, in corners or angles, where the recovery of the patient is rather the exception than the rule. Rooms for the reception of the sick become permeated with organic impurities, and it is often a sanitary measure to pull them down and rebuild with fresh material. One portion of a concert-room or theatre is often found to contain twice as large a percentage of carbonic-acid gas as another; seats, where offensiveness of breath, of personal emanations, or of perfumery, seems to cling; places, where the range of the thermometer is five or six degrees higher or lower than at others.

It is not volume of air, then, only, that is requisite for good ventilation, but also uniform distribution and a separation of the individual emanations, that they may pass off as independently as possible. High, ample rooms are often spoken of, from their mere size, as well ventilated; and yet, in a large crowd, a person might be almost suffocated, in certain stages of the atmosphere, in a hall without a roof, if fresh air were not introduced from beneath. Many an inspector can bear testimony to the sickening odor of a tenement-house back-yard, open to the sky. It is not so much the size of the room as the circulation of the air that makes it comfortable and healthy. The smaller the room, with the introduction and the withdrawal of the same volume of air, the oftener the air will be changed, and consequently the fresher it will be. For the diffusion of the air, and that it may be distributed without the inconvenience of drafts to the person, it has generally been found the best, for summer ventilation, to introduce the cold air at the bottom of the room, and withdraw it at the top, but in winter ventilation to reverse this, introducing the warm air near the ceiling and withdrawing it near the floor. But this does not obtain in all cases, especially where a multitude of gas-burners or lamps contribute largely to the vitiation of the air.

In the buildings visited by Dr. Stiles or myself, it is not probable that, in any case, the volume of air introduced came up to the amount recommended by Dr. Reid or Morin; nor could it be secured without appliances, the cost of which neither public bodies nor private individuals would feel justified in assuming. It has been my aim, therefore, to see whether some cheap and practical way might not be suggested, by which better ventilation might be secured, without the necessity of the introduction of so large a volume of air, and the better isolation of the supply to the individual.

In Booth's Theatre, a fan, driven by a steam-engine, forces air into a chamber beneath the floor of the parquette, which is discharged through numerous holes in the risers of the platforms on which the chairs rest. Were these holes closed, and the frames of the chairs made of gas-pipe, with holes near the top and at the back, the fresh air might be discharged full toward the faces of persons sitting on the next row back, as shown by the arrows, Fig. 1. Each person would take an inspiration of fresh air, and as it was expired, it would rise toward the ceiling, and be discharged through the present apertures. With this system introduced throughout the house, hollow box-rail or chair-frame being made conduits for the supply of fresh air to the parties directly behind them, there would seem to be little to be wished in the matter of ventilation.

FIG. 1.

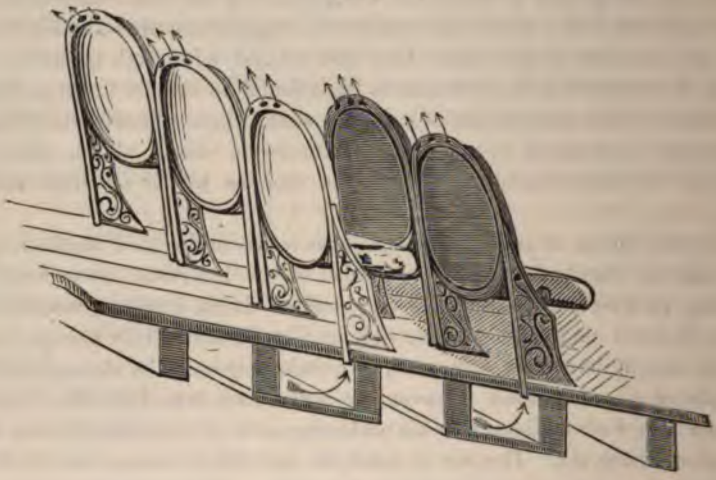
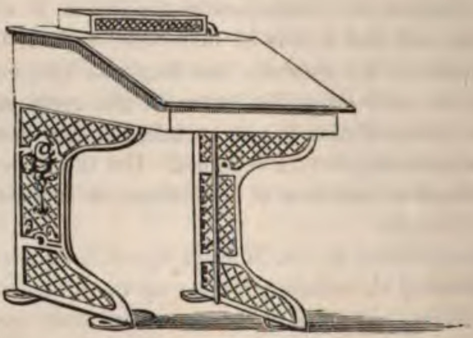


FIG. 2.



In like manner, in school-rooms, were pipes brought up from an air-chamber, or duct in the floor through each desk (Fig. 2) into a box, with a wire-gauze front on the top of the desk, each pupil would receive his independent supply of fresh air, warm or cool, as the season might require; and if the apertures of the educts were some few feet above the level of the heads of the pupils, there would be little chance but that fresh air would be taken in at every respiration.

A system of this kind of ventilation would seem desirable. The question is, whether it is practicable. If the volume to each individual must be equal to that prescribed by Dr. Reid or Morin, the expense of this mode of distribution would be very large; but it seems that such volumes are only requisite on account of the imperfectness of the apparatus for the distribution of the air, and that if the air could be delivered directly to the mouth of each individual, that 30 cub. ft. per *hour* might be amply sufficient, instead of 30 cub. ft. per *minute*.

The spaces between the timbers of the floor-framing would furnish ample room for air-ducts for the supply of 1 cub. ft. of air per minute to each individual, and the distribution could be effected by ¾″ gas-pipe. It remains to determine, on some simple method of forcing the air into the ducts; and there seems nothing better nor more economical than that invented by M. de Mondesir, and adopted at the French Exposition.

"A distinguishing feature of the Exhibition* building was its system of ventilation, which consists in the use of jets of compressed air for carrying in by induction the requisite supply of fresh air to the various departments of the building. Around the whole of the exterior of the Exhibition building is carried a large subterranean gallery, about 9′ 10″ in width, communicating with the external air by means of 16 shafts, each 9′ 10″ diameter, disposed symmetrically around the building, and having their openings distant about 66 feet from the external covered way. In order to conduct the air from the annular gallery to the interior of the palace, 16 radial subterranean shafts were constructed, each extending under the palace 394 feet, or nearly to the centre. Ventilating conduits were constructed communicating with the 16 radial shafts, so that each section of the building could have its supply of air regulated independently of that of the other. The air is admitted into the building from the circular branch-shafts. This induction of the external air is effected by placing in each radial subterranean gallery, almost under the external wall of the building, a jet or nozzle supplied with compressed air; this air, as it escapes, acts like the steam issuing from a blast-pipe, and carries in along the radial gallery a quantity of air with it by induction. The engines for furnishing the necessary supply of compressed air have a total power of 105 horses, nominal. The air is supplied to the jets at a pressure of from 29½ to 31½ inches of water. The escape of the vitiated air takes place through the venetians in the roof. The cost is stated to be about 0.1 franc per 353,165 cubic feet of air supplied."

Fig. 3.

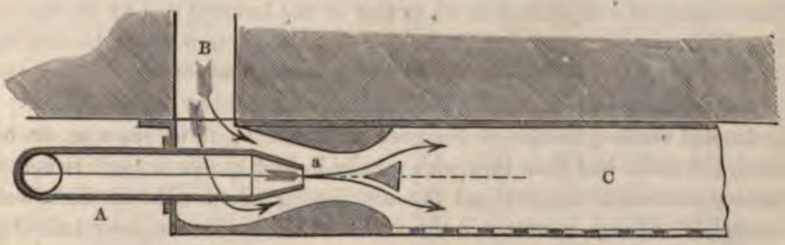


Fig. 3, plan of apparatus on this method which I would propose for the ventilation of a hospital, will more fully explain the action of the De Mondesir invention. A is the pipe furnishing compressed air, as it issues through the nozzle, a, it draws in air from the duct B, and discharges into the box C. This arrangement is proposed for every bed of a hospital, as shown in Figs. 4 and 5.

The box C is just above the head of the patient; its front is perforated with holes or covered with gauze, so that no perceptible current is induced, but the air flows gently in and, as vitiated, is drawn out by ducts beneath the bed.

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* Appletons' Annual Encyclopædia, 1867.

The compressed air may be heated when necessary, and, as the pipe A is passed inward, the comparative volume of induced to compressed air becomes less, and the temperature may be regulated for each bed. There will of course be no dead ends or corners in such a ward, no currents of air to carry contagion from one bed to the other. The volume of air for each individual will be very much less, and the cost on this plan is less than by any means now in use. Experiment can alone demonstrate how much air is required, but, at the cost of one cent for 100,000 cubic feet, very great economy in this respect is not requisite.

FIG. 4.

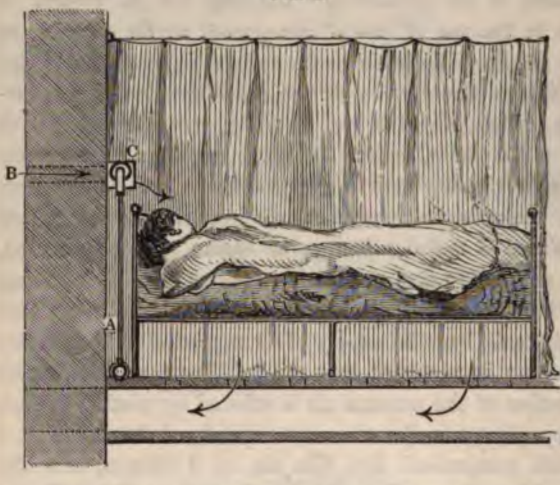
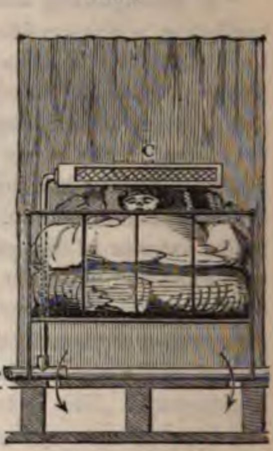


FIG. 5.



It may be objected that this method is only applicable to large institutions where steam-power can be applied, but I think it may be readily made use of for all public buildings. Take the case of a small school of 100 scholars, with a supply of 30 cubic feet to each scholar per hour, or a total of 3,000 cubic feet: If the volume of compressed air be to that of the induced as 1 to 19, the compressed air necessary per hour will be 150 cubic feet, or 750 cubic feet for a session of five hours—which would be about the capacity of a gas-holder of 10 feet diameter by 10 feet high. If, therefore, an air-holder of this capacity be constructed on the principle of the gas-holder, and be raised by man or boy-power, the mains laid from this, with nozzles in each air-duct, would induce satisfactory currents throughout all the distributing pipes. The air ducts would be supplied through apertnres in the exterior walls, or from a heated air-chamber, or the compressed air might be heated on its passage from the holder to the ducts, uniting, whenever necessary, heating with the ventilation.

Many experiments on this method of ventilation were made preparatory to its introduction into the Exhibition building—satisfactory on a small scale, and, when introduced, very satisfactory to parties at the exposition. It seems well worthy of a trial, such as above proposed, as it unites economy of air-supply with perfect distribution and almost individual ventilation.

Respectfully submitted :

W. E. WORTHEN,

Engineer Metropolitan Board of Health.

Report on the Quality of the Water-Supply during the Year 1869.

To the Secretary of the Metropolitan Board of Health.

SIR: The investigations with regard to the quality of the Croton and Ridgewood water supplies have been continued during the past summer and autumn, under the authority of the Board, and with the coöperation of General George S. Green, Chief Engineer of the Croton Aqueduct Department.

TABLE I.

RESULTS OF EXAMINATIONS OF CROTON WATER DURING THE YEAR 1869. GRAINS OF IMPURITY IN ONE U. S. GALLON OF 231 CUBIC INCHES.

DATE.	Reservoir.	Inorganic Matter.	Organic and Volatile Matter.	Total Solids, (240° F.)	Oxygen required to oxidize Organic Matter.	Carbonate of lime or its equivalent (Hardness).	Depth of Color.
July 6	Central Park	4.54	0.58	5.12	0.0803	2.34	6
" 6	Fifth Avenue	4.19	0.70	4.89	0.0816	2.58	4
" 13	Central Park	4.32	0.80	5.12	0.0749	2.48	6
" 13	Fifth Avenue	4.54	0.58	5.12	0.0815	2.66	5
" 20	Central Park	3.55	0.82	4.37	0.0795	3.24	3
" 20	Fifth Avenue	3.78	0.76	4.54	0.0728	3.29	3
" 27	Central Park	4.31	0.52	4.83	0.0573	3.14	4
" 27	Fifth Avenue	4.25	0.58	4.83	0.0662	3.41	5
Aug. 3	Central Park	4.48	0.29	4.77	0.0639	2.77	5
" 3	Fifth Avenue	4.43	0.41	4.84	0.0595	2.81	4
" 13	Central Park	3.96	0.17	4.13	0.0595	3.48	5
" 13	Fifth Avenue	4.02	0.76	4.78	0.0552	3.57	4
" 17	Central Park	3.32	1.17	4.49	0.0529	3.39	3
" 17	Fifth Avenue	3.55	0.93	4.48	0.0397	3.34	3
" 24	Central Park	4.14	0.29	4.43	0.0441	3.43	4
" 24	Fifth Avenue	4.37	0.29	4.66	0.0419	3.41	3
" 31	Central Park	3.67	0.93	4.60	0.0485	3.67	6
" 31	Fifth Avenue	3.96	0.82	4.78	0.0441	3.57	4
Sept. 7	Central Park	4.84	0.12	4.96	0.0441	3.60	4
" 7	Fifth Avenue	5.01	0.29	5.30	0.0463	3.64	6
" 14	Central Park	3.85	0.99	4.84	0.0463	3.67	7
" 14	Fifth Avenue	4.31	0.93	5.24	0.0397	3.81	6
" 28	Central Park	4.83	2.10	6.93	0.0522	3.66	6
" 28	Fifth Avenue	5.07	1.39	6.46	0.0530	3.71	4
Oct. 12	Central Park	4.78	0.47	5.25	0.0397	3.76	4
" 12	Fifth Avenue	3.15	2.10	5.25	0.1322	1.93	16
" 26	Central Park	5.60	0.23	5.83	0.0838	3.00	5
" 26	Fifth Avenue	3.91	0.41	4.32	0.0816	2.63	7
Nov. 9	Central Park	4.43	0.46	4.89	0.0684	3.07	5
" 9	Fifth Avenue	3.85	0.41	4.26	0.0728	2.75	9
" 23	Central Park	3.96	0.58	4.54	0.0750	2.81	4
" 23	Fifth Avenue	3.85	0.23	4.08	0.0705	2.67	6
Dec. 8	Central Park	3.32	0.87	4.19	0.0662	2.65	5
" 8	Fifth Avenue	3.15	0.94	4.09	0.0727	2.61	6
" 21	Central Park	3.26	0.12	3.38	0.0551	2.70	5
" 21	Fifth Avenue	3.38	0.12	3.50	0.0551	2.59	5
	Average for six months	4.11	0.67	4.78	0.0627	3.10	5.2

The samples were taken weekly during the months of July, August, and September, and semi-monthly during the other months: the Croton from the Central Park and Fifth Avenue Reservoirs, the Ridgewood from the Ridgewood Reservoir and Court-house Hydrant in Brooklyn.

TABLE II.

RESULTS OF EXAMINATIONS OF RIDGEWOOD WATER MADE DURING THE YEAR 1869. GRAINS OF IMPURITY IN ONE U. S. GALLON OF 231 CUBIC INCHES.

DATE.	Source of Water.	Inorganic Matter.	Organic and Volatile Matter.	Total Solids, (240° F.)	Oxygen required to oxidize Organic Matter.	Carbonate of Lime or its equivalent (Hardness).	Depth of Color.
July 6	Ridgewood Reservoir	4.13	0.52	4.65	0.0705	1.35	10
" 6	Court-house Hydrant	3.96	0.70	4.66	0.0913	1.39	7
" 13	Ridgewood Reservoir	3.37	1.16	4.53	0.0462	1.35	7
" 13	Court-house Hydrant	3.49	0.93	4.42	0.0638	1.35	8
" 20	Ridgewood Reservoir	2,68	0.99	3.67	0.0463	1.60	5
" 20	Court-house Hydrant	3.09	0 64	3.73	0.0441	1.60	6
" 27	Ridgewood Reservoir	4.79	0.41	4.20	0.0374	1.83	3
" 27	Court-house Hydrant	3.84	0.58	4.42	0.0573	1.47	6
Aug. 3	Ridgewood Reservoir	3.55	0.23	3.78	0.0382	1,40	3
" 3	Court-house Hydrant	3.61	0.35	3.96	0.0551	1.36	7
" 13	Ridgewood Reservoir	3.32	0.29	3.61	0.0419	1.60	3
" 13	Court-house Hydrant	3.26	0.76	4.02	0.0375	1.55	5
" 17	Ridgewood Reservoir	2.27	1.33	3.60	0.0287	1.86	3
" 17	Court-house Hydrant	2.56	1,28	3.84	0.0331	1.62	6
" 24	Ridgewood Reservoir	3.14	0.35	3.49	0.0242	1.50	6
" 24	Court-house Hydrant	3.26	0.47	3.73	0.0221	1.50	6
" 31	Ridgewood Reservoir	2.85	0.70	3.55	0.0287	1.48	3
" 31	Court-house Hydrant	1.98	1.16	3.14	0.0265	1.48	3
Sept. 7	Ridgewood Reservoir	3.55	0.23	3.78	0.0220	1.64	7
" 7	Court-house Hydrant	3.73	0.29	4.02	0.0220	1.59	8
" 14	Ridgewood Reservoir	3.26	0.47	3.73	0.0267	1.50	5
" 14	Court-house Hydrant	2.97	0.58	3.55	0.0242	1.43	5
" 28	Ridgewood Reservoir	5.01	1.23	6.24	0.0331	1.55	3
" 28	Court-house Hydrant	3.84	1.75	5.59	0.0308	1.60	4
Oct. 12	Ridgewood Reservoir	2,80	0.69	3.49	0.0948	1.42	12
" 12	Court-house Hydrant	3.61	0.81	4.42	0.1059	1.49	14
" 26	Ridgewood Reservoir	3.85	0.47	4.32	0.0750	1.33	8
" 26	Court-house Hydrant	3.03	0.58	3.61	0.0728	1.35	9
Nov. 9	Ridgewood Reservoir	3.87	0.00	3.87	0.0513	1.38	10
" 9	Court-house Hydrant	3.14	0.00	3.14	0.0463	1.46	9
" 28	Ridgewood Reservoir	3.85	0.23	4.08	0.0418	1.43	11
" 23	Court-house Hydrant	3.50	0.12	3.62	0.0418	1.40	10
Dec. 8	Ridgewood Reservoir	3.15	0.46	3.61	0.0330	1.47	8
" 8	Court-house Hydrant	3.15	0.46	3.61	0.0330	1.52	8
" 21	Ridgewood Reservoir	3.08	0.06	3.14	0.0243	1.47	4
" 21	Court-house Hydrant	3.08	0.06	3.14	0.0243	1.47	4
	Average for six months	3.37	0.59	3.92	0.0443	1.49	6.5

Tables I. and II. show the impurities in one gallon of 231 cubic inches, or 58,318 grains of water.

Tables III. and IV. show the impurities in 100,000 parts of water, for convenience of comparison with the water of other cities, where the U. S. gallon is not employed.

The 1st column shows the inorganic matter, which is detected by igniting the residue obtained on evaporating the water, moistening it with carbonic-acid water to restore carbonic acid to the lime and magnesia, and drying at 260° F.

The 2d column shows the organic and volatile matter.

The 3d column shows the total amount of solids, obtained by evaporating the water in a platinum dish, and drying it at 260° F., or 130° C.

The 4th column shows the amount of oxygen required to oxidize the organic matter. This is considered a measure of the quality of the organic matter, which is supposed to be injurious in proportion as it is ready to undergo oxidation. In Dr. Letheby's reports of analyses of London waters, made to the Metropolitan Association of Medical Officers of Health, this oxygen is supposed to represent eight times its weight of oxidable organic matter, and is so reported.

TABLE III.

RESULTS OF EXAMINATIONS OF CROTON WATER MADE DURING THE YEAR 1869.
RESULTS CALCULATED FOR 100,000 PARTS OF WATER.

DATE.	Reservoir.	Inorganic Matter.	Organic and Volatile Matter.	Total Solids, (240° F.)	Oxygen required to oxidize Organic Matter.	Carbonate of Lime or its equivalent (Hardness).	Depth of Color.
July 6	Central Park	7.80	1.00	8.80	0.1379	4.03	6
" 6	Fifth Avenue	7.20	1.20	8.40	0.1402	4.44	4
" 13	Central Park	7.40	1.40	8.80	0.1289	4.27	6
" 13	Fifth Avenue	7.80	1.00	8.80	0.1401	4.58	5
" 20	Central Park	6.10	1.40	7.50	0.1364	5.56	3
" 20	Fifth Avenue	6.50	1.30	7.80	0.1250	5.65	3
" 27	Central Park	7.40	0.90	8.30	0.0984	5.41	4
" 27	Fifth Avenue	7.30	1.00	8.30	0.1136	5.85	5
Aug. 3	Central Park	7.70	0.50	8.20	0.1097	4.75	5
" 3	Fifth Avenue	7.60	0.70	8.30	0.1022	4.82	4
" 13	Central Park	6.80	0.30	7.10	0.1022	5.97	5
" 13	Fifth Avenue	6.90	1.30	8.20	0.0946	6.13	4
" 17	Central Park	5.70	2.00	7.70	0.0908	5.81	3
" 17	Fifth Avenue	6.10	1.60	7.70	0.0681	5.73	3
" 24	Central Park	7.10	0.50	7.60	0.0756	5.89	4
" 24	Fifth Avenue	7.60	0.50	8.10	0.0710	5.85	3
" 31	Central Park	6.30	1.60	7.90	0.0832	6.29	6
" 31	Fifth Avenue	6.80	1.40	8.20	0.0756	6.13	4
Sept. 7	Central Park	8.30	0.20	8.50	0.0756	6.17	4
" 7	Fifth Avenue	8.60	0.50	9.10	0.0794	6.25	6
" 14	Central Park	6.60	1.70	8.30	0.0794	6.29	7
" 14	Fifth Avenue	7.40	1.60	9.00	0.0681	6.53	6
" 28	Central Park	8.30	3.60	11.90	0.0946	6.29	6
" 28	Fifth Avenue	8.70	2.40	11.10	0.0908	6.37	4
Oct. 12	Central Park	8.20	0.80	9.00	0.0681	6.45	4
" 12	Fifth Avenue	5.40	3.60	9.00	0.2269	3.31	16
" 26	Central Park	9.60	0.40	10.00	0.1437	5.16	5
" 26	Fifth Avenue	6.70	0.70	7.40	0.1399	4.52	7
Nov. 9	Central Park	7.60	0.80	8.40	0.1173	5.27	5
" 9	Fifth Avenue	6.60	0.70	7.30	0.1248	4.72	9
" 23	Central Park	6.80	1.00	7.80	0.1286	4.82	4
" 23	Fifth Avenue	6.60	0.40	7.00	0.1210	4.59	6
Dec. 8	Central Park	5.70	1.50	7.20	0.1135	4.55	5
" 8	Fifth Avenue	5.40	1.60	7.00	0.1248	4.48	6
" 21	Central Park	5.60	0.20	5.80	0.0945	4.64	5
" 21	Fifth Avenue	5.80	0.20	6.00	0.0946	4.45	5
	Average for six months	7.07	1.15	8.20	0.1074	5.36	5.2

The 5th column shows the hardness of the water, determined by its effect upon soap, the numbers represent carbonate of lime or its equivalent in other salts.

The 6th column shows the depth of color exhibited by the water when examined through a long tube. It is difficult to fix an exact standard of comparison; the numbers are therefore merely comparative.

TABLE IV.

RESULTS OF EXAMINATIONS OF RIDGEWOOD WATER MADE DURING THE YEAR 1869. RESULTS CALCULATED FOR 100,000 PARTS OF WATER.

DATE.	Source of Water.	Inorganic Matter.	Organic and Volatile Matter.	Total Solids, (240° F.)	Oxygen required to oxidize Organic Matter.	Carbonate of Lime or its equivalent (Hardness).	Depth of Color.
July 6	Ridgewood Reservoir	7.10	0.90	8.00	0.1211	2.33	10
" 6	Court-house Hydrant	6.80	1.20	8.00	0.1568	2.39	7
" 13	Ridgewood Reservoir	5.80	2.00	7.80	0.0795	2.33	7
" 13	Court-house Hydrant	6.00	1.60	7.60	0.1098	2.33	8
" 20	Ridgewood Reservoir	4.60	1.70	6.30	0.0795	2.74	5
" 20	Court-house Hydrant	5.30	1.10	6.40	0.0757	2.74	6
" 27	Ridgewood Reservoir	6.50	0.70	7.20	0.0643	3.15	3
" 27	Court-house Hydrant	6.60	1.00	7.60	0.1098	2.54	6
Aug. 3	Ridgewood Reservoir	6.10	0.40	6.50	0.0656	2.41	3
" 3	Court-house Hydrant	6.20	0.60	6.80	0.0946	2.34	7
" 13	Ridgewood Reservoir	5.70	0.50	6.29	0.0719	2.74	3
" 13	Court-house Hydrant	5.60	1.30	6.90	0.0643	2.66	5
" 17	Ridgewood Reservoir	3.90	2.30	6.20	0.0492	3.19	3
" 17	Court-house Hydrant	4.40	2.20	6.60	0.0567	2.78	6
" 24	Ridgewood Reservoir	5.40	0.60	6.00	0.0416	2.58	6
" 24	Court-house Hydrant	5.60	0.80	6.40	0.0378	2.58	6
" 31	Ridgewood Reservoir	4.90	1.20	6.10	0.0492	2.54	3
" 31	Court-house Hydrant	3.40	2.00	5.40	0.0454	2.54	3
Sept. 7	Ridgewood Reservoir	6.10	0.40	6.50	0.0378	2.82	7
" 7	Court-house Hydrant	6.40	0.50	6.90	0.0378	2.74	8
" 14	Ridgewood Reservoir	5.60	0.80	6.40	0.0454	2.58	5
" 14	Court-house Hydrant	5.10	1.00	6.10	0.0416	2.46	5
" 28	Ridgewood Reservoir	8.60	2.10	10.70	0.0567	2.66	3
" 28	Court-house Hydrant	6.60	3.00	9.60	0.0529	2.74	4
Oct. 12	Ridgewood Reservoir	4.80	1.20	6.00	0.1626	2.46	12
" 12	Court-house Hydrant	6.20	1.40	7.60	0.1816	2.50	14
" 26	Ridgewood Reservoir	6.60	0.80	7.40	0.1286	2.30	8
" 26	Court-house Hydrant	5.40	1.00	6.40	0.1248	2.34	9
Nov. 9	Ridgewood Reservoir	5.80	0.00	5.80	0.0983	2.36	10
" 9	Court-house Hydrant	5.40	0.00	5.40	0.0794	2.50	9
" 23	Ridgewood Reservoir	6.60	0.40	7.00	0.0719	2.46	11
" 23	Court-house Hydrant	6.00	0.20	6.20	0.0719	2.40	10
Dec. 8	Ridgewood Reservoir	5.40	0.80	6.20	0.0567	2.53	
" 8	Court-house Hydrant	5.40	0.80	6.20	0.0567	2.60	8
" 21	Ridgewood Reservoir	5.30	0.10	5.40	0.0416	2.53	4
" 21	Court-house Hydrant	5.30	0.10	5.40	0.0416	2.53	4
	Average for six months	5.73	1.03	6.76	0.0766	2.56	6.5

TABLE V.

Comparative purity of the Croton Water during the years 1867, 1868, and 1869.

1. *Grains of Impurity in one U. S. Gallon.*

	1867.	1868.	1869.
Inorganic matter	3.90 grains.	3.31 grains.	4.11 grains.
Organic and volatile matter	0.66 "	1.14 "	0.67 "
Total solids	4.56 "	4.45 "	4.78 "
Oxygen required to oxidize the organic matter	0.1055 "	0.098 "	0.0618 "

2. *Results calculated for* 100,000 *Parts of Water.*

	1867.	1868.	1869.
Inorganic matter	6.72 parts.	5.66 parts.	7.07 parts.
Organic and volatile matter	1.12 "	1.97 "	1.15 "
Total solids	7.84 "	7.63 "	8.20 "
Oxygen required to oxidize the organic matter	0.1809 "	0.1680 "	0.1074 "

TABLE VI.

SHOWING THE PURITY OF CROTON AND RIDGEWOOD WATER, AS COMPARED WITH THE WATERS OF OTHER CITIES. THE NUMBERS REPRESENT GRAINS OF IMPURITY IN ONE U. S. OR WINE GALLON OF 231 CUBIC INCHES.

CITY.	Source.	Inorganic Matter.	Organic and Volatile.	Total Solids.
New York	Croton, average of 1869	4.11	0.67	4.78
New York	Well, west of Central Park	38.95	4.59	43.54
Brooklyn	Ridgewood, average of 1869	3.37	0.59	3.92
Jersey City	Passaic River	4.58	2.86	7.44
Trenton	Delaware River	2.93	0.55	3.48
Philadelphia	Schuylkill River	2.30	1.20	3.50
Boston	Cochituate Lake	2.40	0.71	3.11
Albany	Hydrant	8.47	2.31	10.78
Troy	Hydrant	6.09	1.34	7.43
Schenectady	Well, State Street	46.88	2.33	49.21
Utica	Hydrant	5.50	0.96	6.46
Syracuse	New Reservoir	12.13	1.80	13.93
Rochester	Genesee River	12.02	1.23	13.25
Cleveland	Lake Erie	4.74	1.53	6.27
Chicago	Lake Michigan	5.62	1.06	6.68
Dublin	Lough Vartry	1.77	1.34	3.11
London	Thames River	15.55	0.83	16.38
London	Well, Leadenhall Street	90.38	9.59	99.97
Paris	River Seine	7.83	1.00	8.83
Amsterdam	River Vecht	14.45	2.13	16.58
Amsterdam	Well, Kaisersgracht	64.55	4.38	68.93

TABLE VI.

Composition of the impurities of Croton Water. Grains in one U. S. Gallon.

Chloride of sodium	0.402	grains.
Sulphate of potassa	0.179	"
Sulphate of soda	0.260	"
Sulphate of lime	0.158	"
Bicarbonate of lime	2.670	"
Bicarbonate of magnesia	1.913	"
Silica	0.621	"
Alumina and oxide of iron	trace	"
Organic matter	0.670	
Total solids	6.873	

These numbers represent the compounds as they are supposed to exist in solution in the water; the bicarbonates being calculated with one equivalent of water. The residue obtained by evaporating one gallon of the water would be only 5.039 grains.

The actual results of the analysis were:

Soda	0.326	grains.
Potassa	0.097	"
Lime	0.988	"
Magnesia	0.524	"
Chlorine	0.243	"
Sulphuric acid	0.322	"
Silica	0.621	"
Alumina and oxide of iron	trace	"
Carbonic acid (calculated)	2.604	"
Water in bicarbonates (calculated)	0.532	"
Organic matter	0.670	"
	6.927	
Deduct oxygen equivalent to chlorine	.054	
	6.873	

The results of the analyses made during the year 1869 prove that the Croton and Ridgewood Waters continue to reach the cities of New York and Brooklyn in a condition of great purity. These waters are naturally very free from inorganic and organic impurities, and they are not exposed to contamination by sewage or the waste products of manufacturing establishments before they reach the covered aqueducts.

LEAD IN THE CROTON WATER.

Attention having been called to the frequent cases of chronic lead-poisoning which occur in the city, examinations were made of Croton water which had been in contact with lead for different lengths of time under usually-occurring circumstances, of which the following are the results:

1. A gallon of Croton water from a lead-lined cistern, in which it had stood for several weeks, was found to contain 0.06 grain of metallic lead.

2. A gallon of water, which had remained six hours in the lead-pipes of the Chemist's residence, yielded 0.11 grain metallic lead, a considerable portion of which was visible to the eye, in the form of minute white spangles of the hydrated oxycarbonate $(PbO, HO + PbO, CO_2)$.

3. Water drawn from one of the hydrants of the School of Mines' Laboratory, in the middle of the day, when the water is in constant motion, yielded traces of lead. This water reaches the school through about 100 to 150 feet of lead-pipe.

These results indicate the source of many hitherto unaccountable cases of lead-poisoning, and are of a character to lead the residents of New York to adopt precautionary measures for protection against this insidious cause of disease.

Many have already introduced, as a substitute for lead pipe, the "tin-lined" or "lead-encased block-tin" pipe.

Certainly no pains should be spared to impress upon servants the importance of allowing the water to run for a few minutes before taking it for drinking or cooking purposes, especially early in the morning, after the water has stood all night in the pipes. The habit of filling the tea-kettle from the boiler, or of using water from the boiler for any purpose except washing, is very dangerous. Experiment No. 2 explains a case which recently occurred in New York: An elderly gentleman was completely prostrated with paralysis or palsy. His physician at once suspected lead-poisoning from his symptoms, and instituted inquiries which developed the fact that the patient had been using wheaten grits for dyspepsia, and that the first duty of the cook in the morning had been to soak them preparatory to boiling them. She had, therefore, used daily the water which had stood all night in the pipes. The occurrence of a considerable portion of the lead, in experiment No. 2, in suspension, instead of solution, is an additional argument for the use of filters, though it will, of course, be useless to employ them unless they are frequently reversed, that they may be cleaned.

I have been aided in these investigations by Dr. H. Endemann and W. H. Chandler.

The investigation of the water-supply would have been very incomplete, but for the valuable contributions of Dr. William B. Lewis, who has subjected each sample, analyzed by me, to microscopical examination. As his results are embodied in a separate report, I will not repeat them in detail. It is very desirable that these valuable microscopical investigations be continued.

Respectfully submitted:

C. F. Chandler, Ph. D.,
Chemist to the Metropolitan Board of Health.

REPORT ON THE MICROSCOPICAL EXAMINATION OF THE CROTON AND RIDGEWOOD WATERS.

To ELISHA HARRIS, M. D., *Sanitary Superintendent.*

SIR: Careful microscopical examinations of the metropolitan waters have been made fortnightly during the months of October, November, and December, 1869. They have been intended to throw light upon and complete the chemical examinations regularly carried on throughout the year.

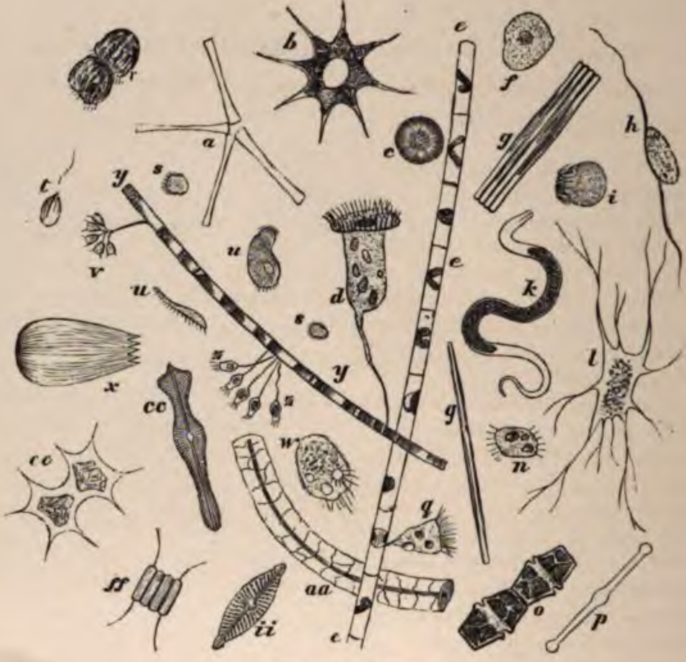
CROTON WATER.

The Croton water has been taken from both the Central Park and Fifth Avenue Reservoirs. The result of the investigation has been to show that, except during severe freshets, especially such as come after a prolonged absence of rain, the Croton water is quite free from contamination with waste organic material derived from man or his industries. Such a freshet as has been mentioned occurred early in October of this year. During its existence the water was strongly tinted brown and contained an unusual proportion of decayed vegetable material, with sand, and also dyed fibres of wool and cotton derived from clothing, rags, dust, and the like, and epithelial cells such as line the various mucous canals of the higher animals. These cells were supposed to come from manure, as their most likely source, and to indicate pollution from the overflow of river-banks, or cultivated or pasture lands. The appearance of such objects was of short duration; it should teach the importance of frequently cleansing and renewing the movable parts of our filters at such periods.

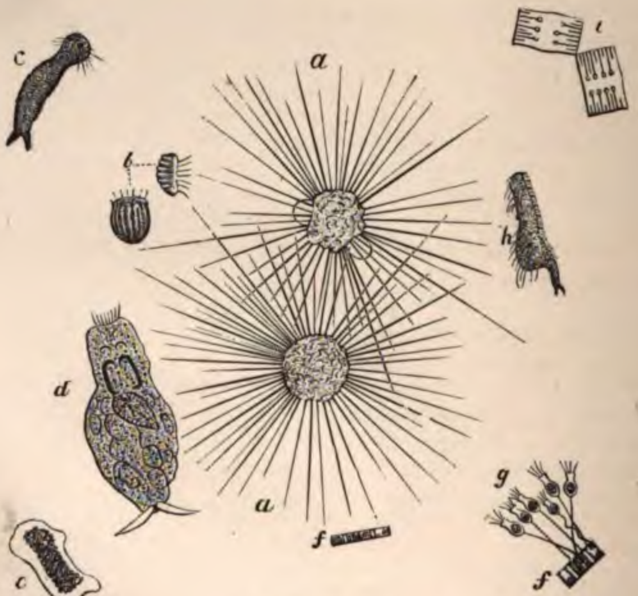
In the accompanying wood-cut (*f*) represents the appearance of such an epithelial cell magnified 200 diameters. A fibre of wool is shown at (*a a*), as observed with the same power.

The Croton water constantly contains more or less numerous representatives of the animal, vegetable, and mineral kingdoms. Of these the vegetable material alone can cause much annoyance. During the fall particularly, the water is apt to throw down a somewhat copious sediment of flocculent brownish material which consists of dead and chiefly amorphous vegetable *débris*, more or less held together by conferva and minute fungus fibres. Each little mass composing this sediment is likely to be inhabited by one or more minute worms, the *Anguillula fluviatilis* (*k*), found in all river-water, and to contain other animalcules and vegetable organisms.

The water from the Fifth Avenue Reservoir often contained nearly fifty per centum (estimated) more vegetable *débris* than that brought from Central Park. This is doubtless due to the greater age of these works and to the coating of the sides and bottom with confervoid and other vegetable matter which becomes detached and is added to that which comes from a higher source.



CROTON WATER.



RIDGEWOOD WATER.

Animal and vegetable objects found in the sediment of Croton water taken from the Central Park and Fifth Avenue Reservoirs during October, November, and December, 1869:

a. Asterionella formosa, vegetable, a diatom, × 312. *
b. Pediastrum simplex, vegetable, a desmid, × 200.
c. Cyclotella astræa, vegetable, a diatom, × 200.
d. Vorticella ——, an animalcule, × 312.
e. Conferva, vegetable, "green scum," × 40.
f. Epithelial cell, probably from manure during freshet, × 200.
g. Fragillaria capucina, vegetable, a diatom, × 200.
h. Heteromita ovata, an animalcule, × 500.
i. Halteria grandinella ?, an animalcule, × 200.
k. Anguillula fluviatilis, a minute water-worm, × 312.
l. Amoeba porrecta, an animalcule, × 200.
n. Diophrys ——, an animalcule, × 200.
o. Didymoprium borreri, vegetable, a desmid, × 200.
p. Tabellaria fenistrata, vegetable, a diatom, × 312.
q. A free vorticella, an animalcule, × 200.
r. Coccudina costata, dividing, an animalcule, × 312.
s. Monas umbra, an animalcule, × 312.
t. Cyclidium abscissum, an animalcule, × 312.
u. Chilodon cucullulus, an animalcule, × 200.
v. Epistylis nutans, young, animalcules, × 200.
w. Paramecium ——, an animalcule, × 200.
x. Difflugia striolata, the lorica or case, an animalcule, × 200.
y. Conferva, vegetable, "green scum," × 312.
z. Vorticella microstoma, an animalcule, × 200.
aa. Fragment of dyed wool, × 200.
cc. Gomphonema acuminatum, vegetable, a diatom, × 200.
ee. Arthrodesmus octocornis, vegetable, a desmid, × 312.
ff. Scenodesmus quadricauda, vegetable, a desmid, × 200.
ii. Navicula rhynchocephala, ? vegetable, a diatom, × 200.

Animal and vegetable objects found in the sediment of Ridgewood water during the same period:

a. Actinophrys sol, an animalcule, × 200.
b. Coccudina costata, an animalcule, × 200.
c. Chætonotus squammatus, hairy-backed animalcule, × 200.
d. Notommata ——, a rotiferous animalcule, × 200.
e. Amœba guttula, an animalcule, × 200.
f. Melosira orichalcea, vegetable, a diatom, × 200.
g. Vorticella microstoma, animalcules, × 200.
h. Chætonotus larus, hairy-backed animalcule, × 200.
i. Tabellaria flocculosa, vegetable, a diatom, × 200.

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* Magnifies 312 diametres.

As the animal and inorganic objects discovered are not known to affect comfort or health, we may pass them by, to briefly enumerate the results of our search in the three kingdoms.

The total number of species noted was somewhat more than fifty.

Belonging to the animal kingdom, twenty species. Belonging to the vegetable kingdom, twenty-eight species. Belonging to the inorganic realm, silicious and cretaceous particles.

In addition to these were some which, on account of rapid motion, partial destruction, or for other reasons, could not be recognized.

There is no doubt also that many species have entirely eluded observation, for in these investigations it is found that the wealth of the results is directly proportioned to the amount of time judiciously expended upon them.

RIDGEWOOD WATER.

The Prospect Park Reservoir, and the Court-house hydrant in Brooklyn, have supplied the specimens of Ridgewood water examined.

During the period over which these observations have extended, at least, this water has exhibited a marked freedom from sediment capable of detection by the unaided eye. Some little there has been at all times, and the quantity has been subject to slight variations; but when compared with Croton water the difference was quite noticeable.*

The small masses of vegetable *débris* found contained the ***anguillula fluviatilis*** with the same constancy as those in the Croton.

There was an entire absence of any evidences of contamination with organic material derived from man or his industries.

At the time, in October, when the Croton was much colored, during a freshet, the Ridgewood retained its usual purity.

The number of species observed in the three kingdoms was thirty-two.

Belonging to the animal kingdom, twenty species. Belonging to the vegetable kingdom, eleven species.

Referred to the mineral kingdom, silicious particles.

The illustrations do not represent organisms found in either water exclusively, nor by any means all which were seen in either. The aim has been to give a view of some of the inhabitants of our daily beverages ***when unfiltered***, and not to repeat largely in one cut what had been shown in the other.

Some of the animalcules of the second illustration were found in Croton water, while several of the vegetable and animal organisms of the first cut were discovered in the Ridgewood.

The objectives used in these observations were manufactured by Zentmayer and Tolles: the lower powers by the former, the higher by the latter. The combination most frequently employed was that of a one-fifth objective, with either the A or B eye-piece, affording when arranged for drawing, with a Beale's neutral tint camera lucida, a magnifying power of 200 diametres, or 312 diametres respectively.

Filtration.—For the purpose of removing the material thus briefly described almost any ordinary filter will suffice, provided it is sufficiently good to prevent the escape of water around the edges of the filtering materials within the metal case. During the fall and spring, especially, but at any period when vegetable sediment is abundant, these filters should be frequently reversed and washed out, or the filtering material renewed. When the Croton water is colored brown during severe freshets it would be well to use charcoal filters. Moderately coarse animal charcoal is the best, and this should daily be renewed if much water passes through, unless the capacity of the filter is considerable. The charcoal removed need not be rejected, but may be heated to redness, and thus caused to regain its full powers.

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* This may be largely due to the newness of the works.

LITERATURE.

The authors and works consulted in naming the animalcules, diatoms, and desmids above mentioned, are the following:

The Micrographic Dictionary, by Dr. Griffith and Prof. Henfrey.
British Desmidicæ, by John Ralfs, 1848.
Infusoria, Desmidieæ, Diatomaceæ. Pritchard, London, 3d edition, 1852, and 4th edition, 1861.
Bailey, Prof. J. W., in Smithsonian Contributions to Knowledge.
The hairy-backed Animalculae, Gosse; Intellectual Observer.
Edwards, Prof., A. M., in the Science Gossip.
Torrey, Prof. John, Report Croton Aqueduct Department, 1859.
The Microscope, Dr. William B. Carpenter.
Synopsis of the British Diatomaceæ, Prof. William Smith.
The Microscope in Practical Medicine, Beale, 1867.
Practical Hygiene, Dr. Parkes, 1869.
Traité d'Hygiene Générale, Dr. A. Motard, 1868.

WILLIAM B. LEWIS, M. D.

as the breed of the cow, her age, the age of her calf, nature of her food, time of milking, frequency of milking; and it is even found that the last milk which comes down at a milking is richer in butter than that which is first drawn. This last-mentioned fact shows that the custom which prevails in some localities of driving the cow from house to house, and supplying the consumer with milk fresh from the udders is not quite equitable, as the last person supplied receives a richer milk than is given to the first customer.

The following analyses illustrate these statements:

3. *Milk from Different Breeds of Cows. Analyses by Vernois et Becquerel.*

Breed.	Water.	Butter.	Casein.	Sugar.	Salts.
Angus	80.32	9.88	5.28	3.73	0.72
Belgian—Durham	85.77	6.22	4.06	3.29	0.67
Bohemian	84.18	6.34	3.87	4.96	0.64
Bretonne	83.74	5.70	5.37	4.55	0.62
Charollais	85.28	6.42	4.12	3.49	0.68
Durham, two analyses	84.56	6.41	4.37	3.97	0.68
Flamande	88.30	3.72	3.37	4.03	0.54
Dutch, three analyses	83.97	6.84	4.21	4.35	0.61
Murzthal	85.31	6.28	3.14	4.62	0.64
Normandy	87.18	3.24	4.76	4.21	0.60
Paris, thirty analyses	86.40	3.61	5.21	4.10	0.66
Swiss	85.19	7.08	2.55	4.59	0.56
Tyrol	81.74	7.96	4.95	4.82	0.50
Voigtland	84.99	5.14	4.56	4.62	0.68
Average, 46 analyses	85.76	4.51	4.86	4.15	0.65

4. *Effect of Food on the Quality of Milk. Analyses by Chevalier.*

	Carrots.	Beets.
Water	86.67	86.87
Butter	3.08	2.75
Casein	4.20	3.75
Sugar	5.30	5.95
Salts	0.75	0.68
	100.00	100.00

5. *Difference in Morning and Evening Milk. Averages of many Analyses by Alex. Müller.*

Water	87.43	86.87
Butter	3.77	4.32
Casein	3.40	3.44
Sugar	4.67	4.66
Salts	0.73	0.71
	100.00	100.00

Methods of Analysis.

1. The water is determined by evaporating a weighed quantity of milk, either alone or soaked up in a known weight of pure, fine quartz sand. The residue is carefully dried at 212° F., and weighed. The loss in weight represents the water, while the residue includes all the solid constituents.

2. The salts are determined by carefully burning off the combustible portion

of the solid residue obtained by evaporation, and weighing the incombustible ash.

3. The butter and casein are determined by coagulating the milk with a few drops of acetic acid, boiling, washing the precipitate with water, and finally separating the butter with ether, leaving the casein pure. On evaporating the ether, the butter is left behind, or the butter may be extracted by ether from the residue obtained by the evaporation of a quantity of milk, soaked up in sand.

4. The sugar is generally determined by deducting the sum of the other constituents from 100. It may be directly determined by the polariscope, after the removal of the casein and butter, or it may be determined by an alkaline solution of copper.

II.—THE ADULTERATION OF MILK.

Numerous substances are mentioned as having been used, or as supposed to be used, for adulterating milk. Prominent among these are:

1. *Water.*—Adulteration with this substance is generally detected by the specific gravity of the milk. Pure milk varies in specific gravity from 1.023 to 1.034, water being represented by 1.000. Milk is heavier than water, on account of the casein, sugar, and salts, which it holds in solution. Butter, on the other hand, is lighter than water, therefore the specific gravity of milk increases with the percentage of casein, sugar, and salts, while it diminishes with the percentages of water or butter. It is found that good milk generally has a specific gravity of from 1.029 to 1.032. In testing milk the lower number is selected as a fair gravity for pure milk; and whenever the gravity falls below this number the milk may be considered as containing an excess of water, and consequently poor in quality or adulterated. An instrument, called a galactometer, has been devised by Dinocourt, for the purpose of testing the quality of milk. It is simply an areometer, so graduated that 100 on the scale represents pure milk, or the gravity 1.029, while 0 represents pure water or gravity 1.000, the space between being divided into 100 parts. The numbers on the scale represent, therefore, the percentages of pure milk.

Skimmed milk, having been deprived of most of its butter, is heavier than whole milk. By skimming the milk before testing it with the galactometer, the error caused by the butter is eliminated. In this case, however, the mark for 100, or pure milk, must be placed lower down on the instrument, as pure milk, having a specific gravity of 1.029, would after being skimmed, have a gravity of about 1.033. The 100° mark for skimmed milk is, therefore, fixed at this point.

The *lactometer* is a simple tube closed at the lower end, and graduated in hundredths. It is designed to measure the quantity of cream which rises on the milk.

By using the two instruments together, the *galactometer* and the *lactometer*, very satisfactory conclusions with regard to the quality of milk can be formed. A perfectly reliable method, though more laborious, is to actually determine the percentage of water in the milk, by evaporating a weighed quantity, and carefully drying the residue at 212° F. If a milk loses more than 88 per cent. of water, having less than 12 per cent. of solids, it may be safely pronounced to be adulterated with water.

2. *Chalk.*—This substance is generally supposed to be extensively used to neutralize the acidity in soured milk, and to produce thickness and opacity, thus concealing dilution with water. It is easily detected, as it is deposited on standing, and can then be recognized by its effervescing with dilute acids. I have never detected it in any sample of milk examined. Its presence would also be shown in a milk analysis, by the unusual amount of ash.

3. *Flour, starch, emulsions of almonds, or hemp-seed, etc.*, are said to be used to thicken milk, and neutralize the blue color caused by dilution. They were not found in any of our samples.

4. *Sugar, gum, dextrin and borax*, to increase specific gravity.

5. *Turmeric and annatto*, to hide the blue color.

6. *Cerebral matter, sheep's brains*, to thicken watered milk, easily detected by the microscope, and by its depositing a peculiar white sediment on standing.

7. *Carbonate or bicarbonate of soda*, to neutralize acidity. Detected by the increase in the quantity of ash, or better by the effervescence of the ash with acids.

III.—THE MILK SUPPLIED TO CONSUMERS IN THE METROPOLITAN DISTRICT.

Two hundred and ninety-seven specimens of the milk supplied to consumers in the Metropolitan District have been submitted to chemical examination. Of these forty-five were seized while undergoing the process of dilution with water, two hundred and forty-five were purchased from the retail dealers, and seven were procured at one of the crowded cow-stables in Brooklyn.

First Series of Analyses.—In the latter part of February, some milkmen were detected in the act of pouring a suspicious fluid, contained in milk-cans, into their milk. They were at once arrested, and taken, with their cans, about fifty in number, to police headquarters. Samples from forty-five of the cans, which were placed in my hands for examination, gave the following results:

Two cans contained water, not any too pure.

Two cans contained water, clouded with a little milk, probably from having been pumped into cans which had contained milk.

Four cans contained water to which considerable milk had been added, the specific gravity varying from 1.010 to 1.017, representing by the galactometer from 37 to 60 per cent. of milk.

Nineteen cans contained milk, to which considerable water had been added, the specific gravity varying from 1.023 to 1.028, representing from 80 to 97 per cent. of milk.

Eighteen cans contained pure milk, varying in specific gravity from 1.029 to 1.030.

None of the samples contained any adulterant save water. The large proportion of pure milk is accounted for by the fact that the work of dilution was interrupted by the police.

Second Series of Analyses.—During the months of June and July a systematic examination of milk was organized, the samples being purchased from retail dealers in various portions of the Metropolitan District. Two hundred and ten samples were analyzed, the following determinations being made in each case:

1. The specific gravity.
2. The percentage of pure milk as shown by the galactometer.
3. The percentage of water.
4. The percentage of solid matter, including butter, casein, sugar of milk, saline constituents, etc.
5. Examination for adulterations.

The results are herewith presented in tabular form, and from them we learn the following facts:

1. The specific gravity varies from 1.010 to 1.032, averaging 1.0208.
2. The percentage of pure milk, as shown by the galactometer, ranges from 37 to 110, averaging 72½.
3. The percentage of water varies from 83.57 to 94.17, averaging 89.89.
4. The percentage of solid constituents, the nutritive portion of the milk, varies from 5.83 to 16.43 per cent., averaging 10.11
5. No adulteration was found in a single instance, save water.

Table I.—Milk Examinations during June and July, 1869.

DEALER.	ADDRESS.	Specific Gravity.	Percentage of Milk by Galactometer.	Percentage of Water by direct Weight.	Total Solids—Butter, Casein, Sugar, etc. Dried at 212° F.
—— McSwyny	497 Pearl Street			87.79	12.21
	14 Franklin	1.029	98	90.14	9.86
D. & A. Boseke	61 Baxter	1.029	98	82.42	17.58
Chas. Doscher	13 Mott	1.032	106	88.80	11.10
	71 Park Place	1.029	98	88.12	11.88
Wm. Moller & Son	524 Pearl	1.020	70	91.18	8.82
C. A. Emmet	21 Mott	1.025	86	89.68	10.32
Daniel Sullivan	67 Park Street	1.025	86	88.33	11.67
D. Driscoll	24 City Hall Place	1.020	70	89.00	11.00
Mrs. Horsey	136 Leonard	1.020	70	88.11	11.89
Galliglian Bros	119 Mulberry	1.025	86	87.84	12.16
J. J. Geaby	22 Mulberry	1.025	86	89.41	10.59
Schreider & Wilken	115 Baxter	1.025	86	86.17	13.83
J. Dellart	40 Eldridge	1.025	86	85.22	14.78
J. Seeldy	36 Park	1.022	76	86.71	13.29
—— McSwyny	497 Pearl	1.022	76	82.97	17.03
A. Knauer	79 Broome	1.025	86	88.72	11.28
C. W. Dainty	234 Worth	1.025	86	88.38	11.62
H. Pentz	119 Baxter	1.025	86	89.41	10.59
A. Horr	263 Rivington	1.020	70	90.09	9.91
J. F. McDowell	92 Henry	1.026	90	87.72	12.28
F. McKenne.	34 Pitt	1.025	86	90.15	9.85
J. McKulloch	Laurel Hill	1.018	63	90.81	9.19
G. Kasselmine	72 Garrick	1.020	70	88.26	11.74
J. McDonald	103 Broome	1.022	76	88.76	11.24
A. Schulingburg	169 Allen	1.025	86	89.01	10.99
J. Wittman	131 E. Houston	1.026	90	88.42	11.58
J. Watjen	34 2d Avenue	1.020	70	89.11	10.89
W. Doyle	79 Ludlow	1.025	86	90.89	9.11
G. Bachmann	51 Ludlow	1.020	70	88.85	11.15
J. Raedig	106 Allen	1.023	80	89.51	10.49
J. M. Oest & Co.	16 2d Avenue	1.023	80	89.12	10.88
Peter Fick	230 6th Avenue	1.025	86	85.55	14.45
D. F. Reck	113 W. 10th	1.025	86	87.79	12.21
F. H. Rohers	58 6th Avenue	1.025	86	87.81	12.29
H. Piefke	18 6th Avenue	1.025	86	88.78	11.22
N. Bremer	4 6th Avenue	1.027	93	88.36	11.64
D. Hopmann	22 Minetta Lane	1.022	76	89.89	10.11

Milk Examinations—(Continued).

DEALER.	ADDRESS.	Specific Gravity.	Percentage of Milk by Galactometer.	Percentage of Water by direct Weight.	Total Solids—Butter, Casein, Sugar, etc. Dried at 212° F.
Wm. Rame	26th Street and 7th Avenue	1.027	93	89.26	10.74
A. Lieberg	257 7th Avenue	1.025	86	87.93	12.07
Russing & Ebert	189 7th Avenue	....	....	87.43	12.57
J. McCrady	134¼ 7th Avenue	1.025	86	87.46	12.54
Wm. J. Acker	21 7th Avenue	1.025	86	88.28	11.72
R. Devans	37 Greenwich Avenue	1.025	86	88.43	11.57
P. Steinmann	105 11th Avenue	1.028	96	87.63	12.37
J. W. Steinbeck	63d Street and 2d Avenue	1.025	86	87.57	12.43
Block & Co	337 54th Street	1.024	83	88.42	11.58
Hermann & Son	1024 2d Avenue	1.022	76	89.18	10.82
—— Cunningham	1008 2d Avenue	1.020	70	89.27	10.73
C. M. Cornell	Astoria	1.020	70	90.14	9.86
—— Futhins	223 E. 53d Street	1.023	80	90.37	9.63
P. Brady	45th Street and Madison Ave.	1.027	93	86.27	13.73
—— McNeal	46th Street and 4th Avenue	1.025	86	83.57	16.43
H. Hallan	338 E. 58th Street	1.020	70	88.90	11.10
E. Thomas	207 E. 36th Street	1.025	86	87.22	12.78
P. Mallach	589 2d Avenue	1.024	83	87.78	12.22
M. Snider	61st Street near 2d Avenue	1.012	44	....	....
G. Hammer	57th Street near 5th Avenue	1.025	86	....	....
J. B. Murry	57th Street and 7th Avenue	1.020	70	88.27	11.73
B. Schwietering	813 7th Avenue	1.023	80	88.90	11.10
—— Mills	790 7th Avenue	1.025	86	88.27	11.73
—— Dillinger	412 W. 50th Street	1.027	93	88.64	11.36
J. Bohde	824 2d Avenue	1.025	86	89.60	10.40
C. H. Steinkamm	863 2d Avenue	1.023	80	88.10	11.90
F. Buse	765 2d Avenue	1.020	70	90.25	9.75
Powell & Co.	681 2d Avenue	1.022	76	89.62	10.38
H. Claussen	648 2d Avenue	1.027	93	88.74	11.26
F. Kriete	82 7th Avenue	1.019	66	91.25	8.75
Bussing & Ebert	189 7th Avenue	1.022	76	88.98	11.02
P. L. Hulle	721 9th Avenue	1.020	70	90.85	9.15
P. Brahnburg	683 9th Avenue	1.023	80	89.36	10.64
—— Bucklage	628 9th Avenue	1.018	63	90.02	9.98
—— Maxwell	558 9th Avenue	1.018	63	90.82	9.18
J. Bernhard	469 9th Avenue	1.025	86	88.47	11.53
R. Doty	315 9th Avenue	1.018	63	92.04	7.96
Browning & Berry	183 9th Avenue	1.025	86	88.33	11.67
Wessel & Puckley	2 9th Avenue	1.025	86	88.79	11.21
H. H. Krogan	518 10th Avenue	1.020	70	89.73	10.27
—— Fight	500 10th Avenue	1.012	44	93.25	6.75
M. Schnied	368 10th Avenue	1.017	60	90.31	9.69
D. Hunkey	327 10th Avenue	1.018	63	90.70	9.30
E. Ryan	263 10th Avenue	1.018	63	91.00	9.00
—— Hunker	242 10th Avenue	1.023	80	91.54	8.46
J. O. Sullivan	153 10th Avenue	1.013	47	92.26	7.74
J. Ruter	770 Greenwich	1.014	50	91.41	8.59
P. Hohre	744 11th Avenue	1.015	53	92.32	7.68
—— Murray	673 4th Avenue	1.021	73	91.07	8.93
P. Swick	609 10th Avenue	1.017	60	91.16	8.84
—— Plunket	517 10th Avenue	1.031	103	85.47	14.53
A. Marquart	422 10th Avenue	1.024	83	90.22	9.78
P. O. Sullivan	153 10th Avenue	1.015	53	92.39	7.61
Austin Yearks	118 9th Avenue	1.022	76	89.92	10.08
F. Panaxtre	160 8th Avenue	1.016	56	91.61	8.39
John Maurer	997 1st Avenue	1.023	80	89.73	10.27
H. Berns	839 1st Avenue	1.021	73	91.02	8.98
H. Rick	815 1st Avenue	1.017	60	91.47	8.53
C. H. Katter	547 1st Avenue	1.016	56	91.99	8.01
H. D. Bruns	445 1st Avenue	1.020	70	91.36	8.64
P. D. Cordes	429 1st Avenue	1.017	60	90.58	9.42
John M. Oest	383 1st Avenue	1.020	70	90.60	9.40
F. Purdy	319 1st Avenue	1.020	70	90.21	9.79
John Spielmann	222 1st Avenue	1.015	53	91.64	8.36
—— Oppenheimer	201 1st Avenue	1.020	70	90.29	9.71
Henry Klenke	146 1st Avenue	1.020	70	90.43	9.57
D. Klenke	115 1st Avenue	1.019	66	90.54	9.46
A. Schulz	96 1st Avenue	1.023	80	90.70	9.30
David Roemer	60 1st Avenue	1.015	53	91.72	8.28
Henry Malsey	26 1st Avenue	1.015	53	92.09	7.91
A. Schulte	11 1st Avenue	1.018	63	90.80	9.20
John Thiel	207 Avenue A	1.015	53	91.93	8.07
Chas. Mincum	147 Avenue A	1.017	60	91.20	8.80
F. Ebenger	149 Avenue A	1.015	53	92.03	7.97
John Hoopner	41 Avenue A	1.018	63	93.08	6.92

Milk Examinations—(Continued).

DEALER.	ADDRESS.	Specific Gravity.	Percentage of Milk by Galactometer.	Percentage of Water by direct Weight.	Total Solids—Butter, Casein, Sugar, etc. Dried at 212° F.
H. & P. Theil	22 Avenue A	1,012	44	92.61	7.39
Mrs. Surman	175 Suffolk	1,018	63	91.14	8.86
Henry Bartell	16 Suffolk	1,020	70	90.70	9.30
—— Behyl	166 Avenue B	1,014	50	92.26	7.74
Meyer & Co	94 Avenue B	1,018	63	91.48	8.52
—— Corkersburg	64 Avenue B	1,020	70	89.70	10.30
Christ. Siles	32 Avenue B	1,015	53	92.77	7.23
Peter Bäker	11 Avenue B	1,020	70	92.76	7.24
P. Ahleim	203 Avenue C	1,014	50	92.60	7.40
John Ricken	174 Avenue C	1,014	50	92.92	7.08
	107 Avenue C	1,015	53	91.46	8.54
Riese & Brother	69 Avenue C	1,015	53	92.04	7.96
Will. Barkler	14 Avenue C	1,015	53	92.31	7.69
J. Cabbenger	6 Avenue C	1,012	44	94.17	5.83
John Holsten	79 Pitt	1,015	53	93.43	6.57
Peter Kooney	54 Pitt	1,015	53	91.80	8.20
H. Kinkan	74 Avenue D	1,015	53	91.80	8.20
F. Brohel	22 Avenue D	1,015	53	92.35	7.65
A. Moeller	16 Avenue D	1,010	37	93.41	6.59
P. Schmidt	101 Columbia	1,013	47	91.85	8.15
Otto H. Coop	74 Columbia	1,020	70	88.98	11.02
Will. Katgin	365 3d Avenue	1,010	37	93.03	6.97
H. Devender	245 3d Avenue	1,012	44	93.08	6.92
L. Balor	415 3d Avenue	1,013	47	92.29	7.71
C. Fisher	478 3d Avenue	1,015	53	90.82	9.18
J. G. Gerdes	557 3d Avenue	1,013	47	91.95	8.05
D. H. Schulz	605 3d Avenue	1,015	53	91.13	8.87
G. E. Wehmann	40 Franklin	1,015	53	91.00	9.00
H. F. Cordes	39 Elm	1,019	66	90.35	9.65
H. Tienchen	66 W. Broadway	1,015	53	91.40	8.60
H. F. Newman	7 Harnson	1,025	86	89.73	10.27
Ph. Fewriug	93 Elm	1,018	63	89.31	10.69
W. Smith	165 Avenue A	1,028	96	88.53	11.47
F. Intemann	353 Greenwich	1,022	76	88.87	11.13
—— Newrenberg	1 Lispenard	1,026	90	89.10	10.90
L. Walker	139 W. Broadway	1,022	76	90.08	9.92
D. Stowesand	97 W. Broadway	1,026	90	89.10	10.90
—— Wisschusen	16 York	1,022	76	90.08	9.92
John Moss	33 Leonard	1,025	86	88.80	11.20
J. Balch	133 Greenwich	1,022	76	90.68	9.32
M. Hertily	26 Rector	1,024	83	89.32	10.68
J. P. Koplic	145 Greenwich	1,025	86	88.00	12.00
C. Maerbeck	135 Liberty	1,024	83	88.63	11.37
P. Flynn	151 Washington	1,025	86	88.02	11.98
G. F. Broggensen	91 Greenwich	1,020	70	90.77	9.23
J. McDonald	19 Albany	1,022	76	89.30	10.70
—— Wette	Carlisle and Washington	1,025	86	89.84	10.16
D. McCarthey	8 Morris	1.020	70	90.33	9.67
K. E. Enright	12 Greenwich	1.021	73	91.29	8.71
J. H. Gentzen	28 Greenwich	1,024	83	88.40	11.60
M. Henken	40 Greenwich	1,023	80	87.80	12.20
M. Kelly	4 Morris	1.016	56	91.54	8.46
Michael Landy	29 Washington	1.020	70	89.87	10.13
Michael O'Connor	71 Washington	1.015	53	91.56	8.44
Philip Shelan	24 Morris	1,022	76	88.95	11.05
Mrs. Pritching	401 E. 18th Street	1.018	63	91.53	8.47
—— Jaggart	342 1st Avenue	1,021	73	88.53	11.47
J. M. Oest	303 1st Avenue	1,020	70	90.67	9.33
A. Spielmann	220 1st Avenue	1.020	70	89.84	10.16
C. Wolfart	275 1st Avenue	1,022	76	89.11	10.89
D. Leopold	402 2d Avenue	1,025	86	89.74	10.26
A. Kneble	318 E. 22d Street	1.020	70	89.42	10.58
J. C. Reisen	407 E. 19th Street	1.018	63	90.01	9.99
L. Remshardt	206 Avenue A	1.024	83	88.93	11.07
Patrick O'Connor	224 Avenue A	1.021	73	90.28	9.72
J. Pentar	512 E. 15th Street	1.023	80	89.18	10.82
J. Haukamp	227 E. 21st Street	1.024	83	88.97	11.03
E. Wehrenberg	361 2d Avenue	1.020	70	89.53	10.47
P. W. Sanders & Co.	258 Avenue A	1.024	83	88.07	11.93
C. F. Wilken	273 Avenue A	1.023	80	89.11	10.89
J. Priede	323 Avenue A	1.015	53	90.51	9.49
Peter Peterson	231 Avenue B	1.019	66	90.18	9.82
F. Fippinger	546 E. 11th Street	1.020	70	89.10	10.90
J. Beek	509 E. 11th Street	1.018	63	90.47	9.53
F. Ebinger	149 Avenue A	1.016	56	89.99	10.01

Milk Examinations—(Continued).

DEALER.	ADDRESS.	Specific Gravity.	Percentage of Milk by Galactometer.	Percentage of Water by direct Weight.	Total Solids—Butter, Casein, Sugar, etc. Dried at 212° F.
H. Wesemans	286 E. 10th Street	1.020	70	89.71	10.29
P. Lahr	341 E. 10th Street	1.023	80	88.45	11.55
H. A. Stegeman	352 E. 10th Street	1.017	60	90.41	9.59
A. Ritz	191 E. 7th Street	1.020	70	88.47	11.53
William Reis	410 E. 6th Street	1.021	73	89.71	10.29
M. Moser	433 E. 6th Street	1.023	80	89.92	10.08
C. Hartungs	437 E. 6th Street	1.025	86	89.28	10.72
C. D. Schupp	502 E. 6th Street	1.023	80	90.07	9.93
Geo. Siemon	507 E. 6th Street	1.021	73	90.00	10.00
C. Hitzel	520 E. 5th Street	1.024	83	89.07	10.93
F. Lautenschleuger	203 E. 4th Street	1.021	73	89.66	10.34
J. Schultz	154 E. 4th Street	1.024	83	89.48	10.52
J. Heubner	41 Avenue A	1.021	73	90.21	9.79
Geo. Finkles	102 E. 3d Street	1.022	76	90.41	9.59
J. Weber	193 E. 3d Street	1.024	83	88.59	11.41
Chris. Silz	32 Avenue B	1.023	80	89.79	10.21
L. A. Betsch	166 E. 3d Street	1.025	86	89.48	10.52
G. Deible	212 E. 3d Street	1.024	83	89.49	10.51
A. Reichert	152 E. 3d Street	1.021	73	90.78	9.22
J. Lang	5 Clinton Street	1.024	83	89.53	10.47
Average		1.0208	72.45	89.89	10.11

Third Series of Analyses.—During the last four months of the year, a series of more elaborate analyses was undertaken, with a view to determine the percentages of some of the individual constituents of the milk. Thirty-five samples were examined, and the results, which are herewith presented in tabular form, establish the fact that—

1. The cream averaged 7.89 per cent., ranging from 5.20 to 11.80 per cent.

2. The percentage of pure milk, as shown by the galactometer, averaged 82.44, varying from 50 to 112.

3. The butter averaged 3.03 per cent., varying from 1.81 to 3.76.

4. The casein and milk-sugar together averaged 6.46 per cent., ranging from 4.16 to 9.02.

5. The saline and earthy constituents averaged 0.59 per cent., varying from 0.39 to 0.87 per cent.

6. The total solids averaged 10.08 per cent., ranging from 6.73 to 12.32 per cent.

7. The water averaged 89.92 per cent., ranging from 87.68 to 93.27 per cent.

8. No adulteration was found in any case save water.

Table II.—Milk Examinations during the last Four Months of 1869.[1]

DATE.	DEALER.	ADDRESS.	Reaction.	Cream.	Percentage of Milk by Galactometer.	Butter.	Casein and Sugar.	Salts.	Total Solids.	Water.
September 22	—— Thiel	20 Avenue A			72	2.68	6.12	0.57	9.37	90.63
" 22	—— Roth	81 Avenue A			73	2.25	5.87	0.53	8.65	91.35
" 22	—— Dorsch	122 E. 7th Street			64	2.62	4.91	0.57	8.10	91.90
" 22	A. Ritler	223 Houston			66	2.09	5.74	0.53	8.36	91.64
" 23		Rockland County		8.5	80	3.25	6.32	0.65	10.22	89.78
" 24	Taylor's Saloon	355 Broadway		8.5	112	2.43	9.02	0.87	12.32	87.68
" 27	C. A. Kelley	105 Avenue C		7.8	50	2.18	4.16	0.39	6.73	93.27
" 27	Riesse Bros	69 Avenue C		6.8	68	2.67	5.57	0.51	8.75	91.25
" 27	—— Barkley	14 Avenue C		6.6	71	2.26	5.97	0.52	8.75	91.25
" 27	—— Jean	265 2d Street		6.6	75	2.82	5.84	0.59	9.25	90.75
October 4	—— Maloney	210 E. 6th Street		7.3	69	3.11	5.90	0.54	9.55	90.45
" 4	—— Busch	213 E. 6th Street		6.2	87	3.05	6.76	0.71	10.52	89.48
" 4	—— Lubkin	233 Bowery		5.2	79	2.91	6.68	0.62	10.21	89.79
" 4	—— Sunken	20 Bleecker		5.3	86	1.81	7.26	0.66	9.73	90.27
" 30	Jacob Stein	Mott and Spring	Neutral.	6.3	86	3.76	6.34	0.65	10.75	89.25
" 30	A. Tienken	297 Mott	Sl. Acid.	7.8	85	2.24	7.35	0.64	10.23	89.77
" 30	Henry Claus Fayen	73 E. Houston	Sl. Acid.	6.5	96	3.02	7.32	0.69	11.03	88.97
November 2	A. Hadden	236 E. 24th Street	Sl. Acid.	12.8	97					
" 17	Michael McBride	194½ Greene	Sl. Acid.	8.6	72	3.21	6.43	0.50	10.14	89.86
" 17	Mary Feliciano	209 Greene	Sl. Acid.	8.3	86	3.32	7.16	0.63	11.11	88.89
" 17	Marcus Martins	197 Greene	Sl. Acid.	6.1	78	3.01	6.24	0.59	9.84	90.16
" 17	Henry Seeberck	157 Greene	Sl. Acid.	8.1	70	3.54	5.76	0.54	9.84	90.16
" 27	Hermann Drewes	226 Chrystie	Sl. Acid.	8.3	100	3.69	7.49	0.67	11.85	88.15
" 27	John Whittman	131 E. Houston	Sl. Acid.	8.0	95	3.12	7.77	0.63	11.52	88.4
" 27	Albert Schulte	11 1st Avenue	Sl. Acid.	6.1	90	2.50	7.32	0.61	10.43	89.57
" 27	John D. Schmidt	185 E. Houston	Sl. Acid.	9.8	90	2.87	8.10	0.62	11.59	88.41
December 11	William Kaltenbach	178 Essex	Sl. Acid.	8.9	97	3.21	7.37	0.63	11.21	88.79
" 11	Hermann Pflug	175 Essex	Sl. Acid.	8.0	96	3.28	7.80	0.63	11.71	88.29
" 11	John Geiss	160 Essex	Neutral.	9.8	82	3.34	6.56	0.52	10.42	89.58
" 11	Christian Schaefer	129 Stanton	Acid.	9.9	88	3.02	6.76	0.58	10.36	89.64
" 16	Michael Reinhardt	217 Stanton	Acid.	8.0	89	2.62	7.17	0.62	10.41	89.59
" 16	Christian Kurtz	96 Willet	Sl. Acid.	9.8	72	2.87	5.83	0.47	9.17	90.83
" 16	Philip Thomas	101 Willet	Sl. Acid.	6.1	100	3.26	7.74	0.67	11.67	88.33
" 16	Jacob Weymar	118 Willet	Sl. Acid.	11.1	82	2.36	6.37	0.49	9.22	90.78
	Average			7.89	82.44	3.03	6.46	0.50	10.08	89.92

Fourth Series of Analyses.—During the month of April, the attention of the Board having been called to the crowded condition of some of the large cow-stables in the Metropolitan District, the Sanitary Superintendent, Dr. Harris, was directed to make an investigation. It was found on examination that, although the stables were over-crowded, dark, and damp, and deficient in ventilation, the animals generally presented a good appearance.

Seven samples of milk were collected and submitted to analysis, with the following results:

	Water.	Butter.	Casein and Sugar.	Salts.
No. 1	90.00	1.31	8.00	0.69
" 2	89.02	2.16	8.10	0.72
" 3	88.88	2.41	7.62	0.79
" 4	88.18	2.54	8.50	0.78
" 5	88.09	2.32	8.75	0.84
" 6	88.48	1.51	9.20	0.81
" 7	89.20	0.84	9.19	0.77
Average	88.85	1.87	8.48	0.77
Healthy Milk	86.00	3.90	9.30	0.80

It appears that the milk of these cows is specially deficient in butter, though it is in *every* respect poorer than the milk of healthy cows. No other indications of disease could be detected in the milk.

The blood of three of these cows was also analyzed, with the following results—the 4th column is an analysis of healthy blood:

	1.	2.	3.	4.
Water	799.81	801.35	843.12	779.06
Fibrin	4.91	5.94	7.63	4.39
Albumen	104.90	69.37	85.22	60.02
Corpuscles	81.10	101.13	51.33	146.50
Extractive	0.95	3.68	6.40	3.20
Soluble Salts	8.33	8.53	6.30	7.01
	1,000.00	1,000.00	1,000.00	1,000.00

The blood of the confined cows is strikingly deficient in red corpuscles, and contains from two to six per cent. more water than the healthy blood. It is thus seen that, while these cows present a fair appearance, they are not in a sound, healthy condition; and, though analysis may fail to detect any specific poison, such milk cannot be considered healthy food.

CONCLUSION.

This investigation establishes the fact that the citizens of the Metropolitan District are generally receiving milk which is free from injurious adulterations, and untainted with disease.

Nevertheless, a fraud is perpetrated upon them in the systematic dilution of the milk with water. The average percentage of pure milk in the adulterated article with which the city is supplied, is 73.28; or, in other words, for every three quarts of pure milk there is added one quart of water. It was stated at the Convention of Milk Producers and Dealers, held at Croton Falls, in March, 1870, that the total amount of milk supplied to the cities of New York and Brooklyn from the surrounding country was about 120,000,000 quarts per annum. To reduce this to the quality of our city supply, requires an addition of 40,000,000 quarts of water, which, at ten cents per quart, costs us the snug sum of $4,000,000 annually, or about $12,000 per day.

I have been aided in this investigation by W. H. Chandler, M. Alsberg, Ph. D., and H. Endemann, Ph. D.

Very respectfully, yours,
C. F. CHANDLER, Ph. D.,
Chemist to the Metropolitan Board of Health.

REPORT ON DANGEROUS KEROSENE.

COLONEL EMMONS CLARK, *Secretary of the Metropolitan Board of Health.*

SIR: The subject of *dangerous kerosene* has received special attention during the past year. Towards the close of 1868, the Chemist to the Board was directed by resolution to investigate the quality of the kerosene sold in the Metropolitan District. In accordance with his instructions, the following report was submitted on January 11, 1869:

COLONEL EMMONS CLARK, *Secretary Metropolitan Board of Health.*

SIR: In response to the resolution of the Board, I beg leave to report that the burning-fluid sold so extensively throughout the United States, under the name of kerosene-oil, is refined petroleum from the oil-wells of Pennsylvania, Ohio, Virginia, Kentucky, and Canada.

As it comes from the wells, petroleum is generally of a dark-yellowish or greenish-brown color, and possesses an odor more or less offensive.

To render it salable it is subjected to a process of refining by which it is rendered almost colorless, and freed as much as possible from its disagreeable odor. One of the most important objects of the purification is, however, the separation of the more volatile constituents, the benzine, keroselene, gasoline, or naphtha, as they are variously called.

These liquids being very volatile, and at the same time very combustible, are the substances which give rise to the explosions which render the use of kerosene so dangerous, and fill the newspapers with accounts of frightful burning accidents.

Their removal, therefore, is a matter of the greatest importance for the consumers of the oil; but unfortunately there is not so ready a sale for the benzine as for the burning oil, consequently its price in the market is less than that of the oil.

The cupidity of the refiner leads him, therefore, to leave as much benzine in the kerosene as possible, regardless of the frightful consequences which result from frequent explosions.

COMPOSITION OF PETROLEUM.

Native petroleum is a mixture of a great number of hydrocarbons, compounds of hydrogen and carbon. These differ from each other in volatility: some are so volatile as to evaporate rapidly at ordinary temperatures, making it dangerous to approach an open tank of petroleum with a flame; others are much less volatile, some requiring a temperature of 700° to 800° Fahr. to vaporize them.

The volatility of these component hydrocarbons is intimately related to their specific gravity or weight, the lightest ones being the most volatile, while the heavier oils possess the high boiling-points. The inflammability of the oils is also intimately connected with the volatility and specific gravity.

The light volatile oils ignite on the approach of a burning match, no matter how cold they may be, while the heavy, less volatile oils can only be ignited when they are heated above the ordinary temperature of the air.

VARIETIES OF PETROLEUM.

There is considerable difference in the character of the petroleum from different wells; some containing large proportions of the light benzine and naphtha, while others are heavy and thick, and suitable for lubricating machinery.

The specific gravity of crude petroleum varies in consequence of these differences from 0.773 (50° Beaumé) to 0.910 (23° Baumé).

The average composition of Pennsylvania petroleum is—

Gasoline	above 65° B.	10
Naphtha	59° to 65° B.	10
Burning oil	36° to 59° B.	76
Lubricating oil	below 36° B.	
Coke and loss		4
	44° B.	100

For want of American examples, the following results of analyses of a number of samples of Italian petroleum, made at the laboratory of the School of Mines, are introduced to illustrate the variety which exists in the oils, even when occurring in the same district:

ITALIAN PETROLEUM.

No.	Gravity.	Naphtha above 59° B.	Burning oil, 59° to 36° B.	Lubricating oil, below 36° B.	Coke and loss.
1	47½° B.	10.00	78.21	9.64	2.15
2	50° B.	9.20	89.65	none.	1.15
3	34° B.		58.93	38.21	2.86
4	26° B.		28.33	77.93	3.74
5	25° B.			96.60	3.40
6	24° B.			97.27	2.73

REFINING PETROLEUM.

The crude petroleum, as it comes from the wells, is subjected to distillation, when the most volatile constituents pass off first, in the form of vapor, and are condensed by passing through a coil of iron pipe surrounded by cold water, and collected as benzine or naphtha. Subsequently the burning oil or kerosene makes its appearance. This is followed by a heavier oil, containing paraffin, and which may be used for lubricating machinery, and there is finally a small residue of tar or coke left in the still.

That portion of the product which is designed for illuminating oil is then subjected to the action of sulphuric acid to remove the odor and color, and destroy a little tar which it still contains. A tarry, acid sediment forms, which is removed. The clear oil is then treated with alkali, to neutralize the last traces of acid.

It is then subjected by the more careful refiners to a somewhat elevated temperature to expel a small percentage of benzine which it still contains.

Thus purified, it constitutes the kerosene oil as it is sold in the market.

QUALITY OF KEROSENE-OIL.

There is no natural dividing line between benzine or naphtha, burning-oil, and lubricating oil.

These liquids flow in a steady, uninterrupted stream from the still. If we collect a sample and test it with the hydrometer, it may have a specific gravity of 75°; then it is light benzine or gasoline; and if we continue to test it from time to time, we shall find that it becomes heavier and heavier, till finally it may perhaps reach 20° Beaumé, when we have heavy lubricating oil.

The fractioning of the distillate is entirely arbitrary, and has resulted from the adaptation of the different products to different purposes in the arts.

In the earlier revenue laws of Congress, the following classification was established:

Gasoline or benzine oils, lighter than 70° Beaumé.

Naphtha, between 59° and 70° Beaumé.

Burning oil, between 36° and 59° Beaumé.

Lubricating oil, below 36° Beaumé.

The refiner tests the stream as it flows from the still, and when it reaches a certain gravity, he diverts it from the benzine-tank to the burning-oil tank.

The conscientious refiner runs all the dangerous oil into the benzine-tank, and only when the oil is sufficiently heavy does he allow it to pass into the "kerosene" receiver. But as the benzine must be sold at a lower price than burning-oil, the refiners are, many of them, led to collect as little benzine and as much kerosene as possible.

It must not be supposed, however, that the specific gravity of the oil can be considered a safe index of its quality. On the contrary, the specific gravity gives very little idea of the quality, for while benzine and gasoline render the kerosene lighter, the gravity of good kerosene is preserved by the presence of heavier oils. So, a poor, dangerous oil may be much heavier than a safe oil.

THE FIRE-TEST.

As the products of petroleum are dangerous in proportion to their inflammability, a fire-test has long been in use, by which the temperature is determined, at which the oil evolves an inflammable vapor—the "vaporizing point"—and the temperature at which the oil itself may be kindled with a burning match—the "burning point."

The vaporizing point of good kerosene-oil should not be much below 100° Fahr. Unfortunately, the results of this investigation show that but little of the oil sold in New York comes up to this standard.

The old law of Congress fixed 110° Fahr. for the burning test, but this law was unfortunately repealed.

The fire laws of New York fix the burning-point at 100° Fahr., which is decidedly too low, as is shown by the great increase in the number of burning casualties.

PROCESSES FOR RENDERING BENZINE NON-EXPLOSIVE.

Processes have been patented, and vendors have sold rights throughout the country, for patented and secret processes, for rendering benzine, gasoline, and naphtha, non-explosive. Thus treated, it is sold under such names as "Liquid Gas," "Aurora Oil," "American Safety Gas," etc.

These patents and secret processes are not only ridiculous, but their sale to ignorant persons is a crime only equalled by murder.

It is impossible to render these light oils non-explosive and safe. The addition of a few grains of alum, potash, borax, alcohol, gum-camphor, etc., to a barrel of benzine does not change its dangerous character in the least. The experiment of pouring a little of the fluid into a bottle and applying a burning match, is no proof whatever, for, to produce an explosion, it is necessary to secure a certain ratio of air to benzine vapor, which it would not be possible to do in a bottle once in fifty times.

The fire-test gives the only sure indication; apply a lighted match to a little of the oil contained in a cup or saucer, and if it can be made to take fire, it should be considered as unsafe, even though the experiment be made in one of the hottest days of summer; should it not take fire, it might still be a dangerous oil, as safe oil must not evolve a combustible vapor below 100° Fahr., nor take fire below 110° Fahr.

Experimenters must be reminded that great care is necessary in applying this test, as persons not accustomed to make such experiments are liable to serious accidents. By carelessly trying the fire-test on a sample of kerosene, a gentleman in New Bedford burned up the entire refinery, oil, barrels, still, and buildings.

QUALITY OF THE KEROSENE-OIL SOLD IN NEW YORK.

In compliance with the direction of the Metropolitan Board of Health, seventy-eight samples of kerosene-oil have been procured from the same number of retail dealers in different parts of the city.

These have been carefully subjected to the fire-test to determine the vaporizing and burning points.

The results are given in the following tabular statement, in which the samples are arranged in the order of quality, beginning with the poorest:

GRAVITY, VAPORIZING POINTS, AND BURNING POINTS, OF THE KEROSENE-OILS SOLD IN NEW YORK.

Number.	LOCALITY.	Gravity, degrees Beaumé.	Vaporizing point, Fahrenheit scale.	Burning point, Fahrenheit scale.
1	40 East Broadway	71.4	*18	*18
2	72 Bayard Street	49.	31	44
3	494 Grand Street	46.6	40	60
4	331 W. Forty-fourth Street	46.3	45	60
5	200 Sixth Avenue	47.2	45	65
6	47 Houston Street,	48.2	45	63
7	216 Canal Street	47.9	48	64
8	822 Second Avenue	50.2	49	72
9	1855 Third Avenue	46.7	51	68
10	164 Avenue C	47.6	52	61
11	5 Pike Street	47.4	53	61
12	104 Avenue D	48.5	54	103
13	655 Seventh Avenue	45.8	57	100
14	548½ Ninth Avenue	48.1	58	87
15	107 Division Street	46.4	58	83
16	566 Eighth Avenue	45.1	58	110
17	665 Eighth Avenue	45.5	59	78
18	793 First Avenue	46.9	61	67
19	104 Division Street	46.6	62	92
20	111 Mulberry Street	46.2	65	97
21	556 Eighth Avenue	45.3	66	83
22	Tenth Ave., cor. Fifty-fourth St.	45.2	66	93
23	88 Division Street	44.5	66	115
24	689 Sixth Avenue	45.9	66	98
25	454 Third Avenue	45.6	66	85
26	21 Mott	45.8	69	87
27	290 Grand Street	48.8	69	89
28	63 East Broadway	45.6	71	103
29	122 Canal Street	44.5	71	113
30	48 Prince Street	46.7	71	104
31	779 First Avenue	45.7	71	98
32	641 Second Avenue	46.9	72	88
33	427 Grand Street	45.8	72	108
34	1917 Third Avenue	46.1	72	98
35	1381 Broadway	45.9	73	97
36	5 Chatham Square	45	73	89
37	297 Houston Street	45.2	74	112
38	1890 Third Avenue	46.2	74	97
39	333 Bowery	44.8	74	101
40	211 Avenue B	45.8	75	94
41	899 Second Avenue	45.5	76	106
42	747 Second Avenue	45.2	77	105
43	490 Seventh Avenue	43.8	77	104
44	67 Mott	46	77	108
45	269 Bowery	44.6	77	96
46	81 Mercer Street	45.3	77	108
47	722 Eleventh Avenue	45.3	77	96
48	Corner Seventh Avenue and Seventeenth Street	45.4	78	99
49	40 Houston Street	45.5	78	102
50	155 Goerck Street	48.8	78	104
51	74 Third Avenue	45.6	78	99
52	98 Eighth Avenue	45.1	79	114
53	Corner Seventh Avenue and Sixteenth Street	46.7	79	105
54	129 Sixth Avenue	45.9	79	100
55	912 Second Avenue	46.3	79	103
56	722 Second Avenve	44.7	80	112
57	853 Second Auenue	46.	80	114
58	113 Mercer Street	45.9	80	101
59	49 Avenue D	45.7	80	103
60	45 Mott Street	45.1	80	106
61	444 Second Street	45.4	80	113
62	108 Mulberry Street	45.4	81	109
63	15 Marion Street	45.1	82	115
64	104 Canal Street	45	83	112
65	562 Ninth Avenue	45	84	104
66	697 Third Avenue	45.5	84	118
67	728 Third Avenue	44.7	85	101
68	57 Division Street	45.1	85	105
69	160 Eighth Avenue	45	86	105
70	332 Tenth Avenue	45.9	86	99
71	633 Second Avenue	45.9	87	92
72	132 Mulberry Street	44.2	88	117
73	808 Second Avenue	45.2	89	107
74	S. Jenny	46.9	90	115
75	860 Second Avenue	45.5	90	106
76	550 Grand Street	46.3	90	108
77	772 Third Avenue	45.5	94	113
78	761 Third Avenue	46	94	113
79	Downer	46.1	109	128

Several of the samples have also been subjected to fractional distillation to determine the proportions of benzine and naphtha which they contain.

COMPOSITION OF KEROSENE SOLD IN NEW YORK.

No.	Locality.	Gravity, degrees Beaumé.	Benzine, gasoline, and naphtha.	Burning oil.
1	40 East Broadway	71.4 B.	90 per cent.	10 per cent.
8	822 Second Avenue	50.2	20 "	80 "
18	793 First Avenue	49.9	10 "	90 "
32	641 Second Avenue	46.9	6 "	94 "
56	722 Second Avenue	44.7	3 "	97 "
67	728 Third Avenue	44.7	3 "	97 "
74	Jenny	46.9	2 "	98 "
79	Downer	46.1	None.	100 "

* Below 18° F.

From these figures it will be seen that not one of the seventy-eight samples, selected at random throughout the city, which are all that were tested, is of a good quality, and may be called safe.

The only safe specimen on the entire list is No. 79, manufactured at the extensive works of Downer, in Boston, and which I obtained from that city by the hands of a friend. When camphene and burning-fluid were in extensive use, and produced such frequent accidents, we could not blame the manufacturers, as it was not possible to make these preparations of turpentine safe. But every refiner can send a perfectly-safe kerosene to market if he chooses; he may make it stand fire at 110° Fahr., 120° Fahr., 130° Fahr., or any other temperature he may elect; it is merely a question of a few cents, more or less, per gallon. Consumers should understand that in demanding the cheapest oil they compel the refiners to supply them with a mixture of benzine and kerosene. Competition is irresistible; and if the price is run down below cost, adulteration must follow. It is a source of gratification to know that Downer, of Boston, has one of the most extensive refineries in the country; he is able to make a perfectly-safe oil, charge a higher price for it, and sell all that he can make. Who would hesitate to pay five, ten, or fifteen cents per gallon for the difference between an oil which is perfectly safe, and one which is liable to destroy one's wife or children at any moment by a horrid death? The first sample on the list, No. 1, contains 50 per cent. of gasoline above 70° B., 40 per cent. naphtha above 59° B., and only 10 per cent. of illuminating oil. It would be safer to have gunpowder in one's lamp, because that substance would remain quietly out of the way of fire, but this oil is so volatile that it seeks the flame of its own accord.

Even the eighth sample contains 20 per cent. of benzine; the eighteenth sample 10 per cent; the thirty-sixth sample 6 per cent.; and no sample, save Downer's, less than 2 per cent. of this dangerous liquid.

The results of this examination will, I think, be sufficiently startling to interest the members of your honorable body in the speedy enactment of suitable laws for the protection of the poorer classes who are not supplied with gas, and are consequently dependent on the honesty of the refiners and retailers of kerosene.

There is only one plan by which the safety of the public can be insured, and that is by the enactment of stringent laws, compelling the refiners to remove these dangerous substances from the kerosene, and inflicting heavy penalties upon those who are reckless enough to endanger the lives of innocent purchasers.

A proper inspection of the kerosene sold, made under the authority of the Board of Health, would prove sufficient to enforce such a law.

For the purpose of registration, the retailers should be required to procure licenses from the Board.

The sale of dangerous oil should be followed by confiscation, loss of license, and perhaps fine.

The investigation is not yet completed, as the study of the lamps in which it is burned is now in progress. In fact, it is only by a study of the lamps that we can decide upon a proper standard for the oil.

I shall, therefore, have the honor to present at an early day a further report upon the lamps designed for burning kerosene-oil. My assistants in this investigation were W. H. Chandler and J. P. Pennington.

C. F. CHANDLER, Ph. D.,
Chemist to the Metropolitan Board of Health.

New York, *January* 11, 1869.

On January 21st the following supplementary report was made by the Chemist to the Board:

Colonel Emmons Clark, *Secretary of the Metropolitan Board of Health.*

Sir: I have the honor to transmit the following supplementary report of the results of the investigation of "Dangerous Kerosene Oil," ordered by the Metropolitan Board of Health.

SUPPLEMENTARY REPORT ON DANGEROUS KEROSENE-OIL.

In continuing the investigation with regard to dangerous kerosene, it was considered a matter of importance to ascertain the temperature to which the oil is heated in the lamps while they are burning, as a knowledge of this point is obviously a preliminary to the establishment of a proper standard for safe oil. To this end twenty-three different lamps were purchased, such as are commonly used in the Metropolitan District. Eleven were of metal, mostly brass; twelve were of glass. These were all filled with the same oil, and allowed to burn for seven hours; the temperature of the oil in each lamp being determined at the end of one, four, and seven hours. The temperature of the room was nearly constant during the experiment, varying from 73° Fahr. to 74° Fahr.

The range of temperature observed was from 76° to 100° Fahr., the highest temperature of 100° having been reached in a brass lamp at the end of the first hour.

That this is an exceptionally high temperature is proved by the fact that the highest temperature reached in any other lamp was 92° Fahr.

The temperatures in the eleven metal lamps varied from 76° to 100° Fahr., the average being 86° Fahr. The temperature in the twelve glass lamps varied from 76° Fahr. to 86° Fahr., the average being 81° Fahr. The average temperature of all the observations on all the lamps was 83° Fahr.

I do not consider these experiments to have established any claim to superior safety on the part of glass lamps; on the contrary, the greater liability to fracture fully counterbalances the slight difference in the heating of the oil. The comparative safety of the different lamps in use can only be determined by an elaborate series of experiments which is beyond the scope of the present investigation.

Moreover, if the retailers of kerosene are compelled by the Board of Health to sell safe oil, the comparative safety of different lamps will be of little consequence.

EXPERIMENTS ON THE TEMPERATURE OF OIL IN BURNING LAMPS.

No.	Kind of Lamp.	Capacity of lamp.	TEMPERATURE OF THE OIL.				
			After one hour.	After two hours.	After four hours.	After seven hours.	Average for the seven hours.
1	Brass hand-lamp...	8 oz.	85° F.	82° F.	85° F.	86° F.	84°5 F.
2	" " "	24 "	79°	83°	84°	82°	82°
3	Glass stand "	8 "	77°	78°	79°	80°	78°5
4	" " "	11 "	77°	81°	84°	82°	81°
5	" " "	20 "	78°	79°	79°	80°	79°
6	" " "	7 "	82°	80°	85°	84°	82°75
7	" " "	10 "	84°	36°	84°	82°	84°
8	Glass hand "	9 "	79°	78°	85°	85°	81°75
9	" " "	6 "	81°	82°	86°	86°	83°75
10	" " "	7 "	80°	78°			79°
11	Brass student-lamp	13 "	82°	80°	83°	84°	82°25
12	Glass stand "	10 "	81°	81°	79°	78°	79°75
13	Brass " "	11 "	92°	89°	88°	86°	88°75
14	Tin lantern	7 "	89°	86°	88°	87°	87°5
15	Glass bracket-lamp	19 "	82°	82°	84°	83°	82°75
16	Glass stand "	29 "	82°	80°	80°	84°	81°5
17	Brass student "	7 "	80°		88°		84°
18	Brass stand "	14 "	84°	85°	87°	87°	85°75
19	" " "	12 "	100°	100°	92°	91°	95°75
20	Metal " "	9 "	82°	82°	88°	87°	84°75
21	Brass " "	12 "	91°	92°	88°	85°	89°
22	Bronze " "	16 "	83°	76°	79°	85°	80°75
23	Glass hand "	"	79°	80°	82°	82°	80°75

These experiments prove that, in the lamps generally used in the Metropolitan District, the temperature does not often rise above 90° Fahr., and that an oil which does not evolve an explosive vapor below 100° Fahr., and does not take fire itself below 110° Fahr., is perfectly safe. I would therefore respectfully recommend that, in making laws to regulate the sale of kerosene-oil in the Metropolitan District, the Board fix 100° Fahr. for the vaporizing point, 110° Fahr. for the burning point of safe oil, and permit none to be sold which falls below this standard. I was assisted in this investigation by W. H. Chandler and J. P. Pennington.

C. H. CHANDLER, Ph. D.,
Chemist to the Metropolitan Board of Health.

New York, *January* 21, 1869.

ACTION OF THE BOARD.

These reports were referred to Mr. D. B. Eaton, Counsel of the Board, and on the 25th of January he reported the following ordinance:

"No petroleum-oil, kerosene-oil, or other liquid having like composition or qualities as a burning-fluid as said oil, shall be kept or offered for sale as a burning-fluid, for lamps or any like receptacle, for the purpose of illumination, nor shall such oil or fluid be purchased for use, or be used as a burning-fluid for any such lamp or receptacle, or be kept for such use, unless all such oil or fluid shall be of such quality and ingredients that it shall stand and be equal to both the following tests and conditions, to wit:

"1. That it shall not take fire or burn at a temperature below 110° Fahr.

"2. That it shall not evolve an explosive vapor below 100° Fahr."

The ordinance was unanimously adopted, and the Sanitary Superintendent, Dr. Elisha Harris, was directed to cause a special inspection to be made by the Chemist to the Board, of the various qualities of kerosene sold throughout the Metropolitan District. The Secretary was also directed to advertise the new ordinance in the daily newspapers for three weeks, at the expiration of which time it will become an operative law.

FURTHER INVESTIGATIONS.

Under the directions of the Board the testing of the kerosene sold in the Metropolitan District was continued. The results of all the tests made are herewith submitted in three tabular statements:

Table I. contains the list of all the safe oils that have been found for sale in the city, 21 samples.

Table II. contains the list of samples which flashed below 100° Fahr., and are consequently unsafe, and below the legal standard, and are liable to cause explosions, although their burning points are above 110° Fahr. They number 280.

Table III. contains the list of samples which do not comply with either test, and are consequently highly dangerous. Twenty-nine of them are naphtha, benzine, or gasoline, the most dangerous substitutes for kerosene, having gravities ranging from 62° B. to 75° B.; these are generally sold as "*safety oils.*" This table includes 335 samples.

The results, therefore, of all the tests are:

Safe oils		21
Dangerous oils, flash below 100° Fahr.	280	
Highly-dangerous oils, below both tests	306	
Naphthas, benzines, and gasolines, sold as safety oils	29	
Total unsafe oils		615
Total number tested		636

SUPPLEMENTARY REPORT ON DANGEROUS KEROSENE-OIL.

In continuing the investigation with regard to dangerous kerosene, it was considered a matter of importance to ascertain the temperature to which the oil is heated in the lamps while they are burning, as a knowledge of this point is obviously a preliminary to the establishment of a proper standard for safe oil. To this end twenty-three different lamps were purchased, such as are commonly used in the Metropolitan District. Eleven were of metal, mostly brass; twelve were of glass. These were all filled with the same oil, and allowed to burn for seven hours; the temperature of the oil in each lamp being determined at the end of one, four, and seven hours. The temperature of the room was nearly constant during the experiment, varying from 73° Fahr. to 74° Fahr.

The range of temperature observed was from 76° to 100° Fahr., the highest temperature of 100° having been reached in a brass lamp at the end of the first hour.

That this is an exceptionally high temperature is proved by the fact that the highest temperature reached in any other lamp was 92° Fahr.

The temperatures in the eleven metal lamps varied from 76° to 100° Fahr., the average being 86° Fahr. The temperature in the twelve glass lamps varied from 76° Fahr. to 86° Fahr., the average being 81° Fahr. The average temperature of all the observations on all the lamps was 83° Fahr.

I do not consider these experiments to have established any claim to superior safety on the part of glass lamps; on the contrary, the greater liability to fracture fully counterbalances the slight difference in the heating of the oil. The comparative safety of the different lamps in use can only be determined by an elaborate series of experiments which is beyond the scope of the present investigation.

Moreover, if the retailers of kerosene are compelled by the Board of Health to sell safe oil, the comparative safety of different lamps will be of little consequence.

EXPERIMENTS ON THE TEMPERATURE OF OIL IN BURNING LAMPS.

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			After one hour.	After two hours.	After four hours.	After seven hours.	Average for the seven hours.
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2	" " "	24 "	79°	83°	84°	82°	82°
3	Glass stand "	8 "	77°	78°	79°	80°	78°5
4	" " "	11 "	77°	81°	84°	82°	81°
5	" " "	20 "	78°	79°	79°	80°	79°
6	" " "	7 "	82°	80°	85°	84°	82°75
7	" " "	10 "	84°	36°	84°	82°	84°
8	Glass hand "	9 "	79°	78°	85°	85°	81°75
9	" " "	6 "	81°	82°	86°	86°	83°75
10	" " "	7 "	80°	78°			79°
11	Brass student-lamp	13 "	82°	80°	83°	84°	82°25
12	Glass stand "	10 "	81°	81°	79°	78°	79°75
13	Brass " "	11 "	92°	89°	88°	86°	88°75
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15	Glass bracket-lamp	19 "	82°	82°	84°	83°	82°75
16	Glass stand "	29 "	82°	80°	80°	84°	81°5
17	Brass student "	7 "	80°		88°		84°
18	Brass stand "	14 "	84°	85°	87°	87°	85°75
19	" " "	12 "	100°	100°	92°	91°	95°75
20	Metal " "	9 "	82°	82°	88°	87°	84°75
21	Brass " "	12 "	91°	92°	88°	85°	89°
22	Bronze " "	16 "	83°	76°	79°	85°	80°75
23	Glass hand "	"	79°	80°	82°	82°	80°75

These experiments prove that, in the lamps generally used in the Metropolitan District, the temperature does not often rise above 90° Fahr., and that an oil which does not evolve an explosive vapor below 100° Fahr., and does not take fire itself below 110° Fahr., is perfectly safe. I would therefore respectfully recommend that, in making laws to regulate the

Oils below Legal Standard by Flashing-test only—(Continued.)

Number.	DATE OF PURCHASE.	DEALER.	LOCALITY.	Specific Gravity. Deg. Beaumé.	Flashing-point. Deg. Fahr.	Burning-point. Deg. Fahr.
170	Aug. 16	W. Clark	217 9th Avenue	48	84	110
172	18	E. H. Hiners	247 "	48	92	114
173	18	N. R. Bodine	292 "	48	88	118
174	18	E. Rosenberg	296 "	47.5	92	128
175	18	E. H. Hannerhurst	325 "	47.5	90	118
176	18	James Farrar	425 "	47.5	89	118
177	18	W. Prede	451 "	48	91	115
178	18	H. & H. Brian	426 "	47	95	126
179	20	L. Mesmer	463 "	47.5	91	112
180	20	J. Bernard	469 "	47	84	116
181	20	J. Bertrand	483 "	47	85	117
183	20	John F. Rempe	523 "	43	93	126
184	20	Mrs. Diettmar	541 "	46	90	129
186	20	—— Boyle	278 3d Avenue	49	94	126
187	20	G. Hojer	302 "	47.5	97	130
188	20	R. McGarrity	334 "	48	76	110
189	20	W. Rathjen	365 "	47.5	85	117
191	20	D. Leopold	402 2d Avenue	46.5	89	118
193	20	E. C. Stoppenhagen	379 "	44.5	91	122
194	20	Wm. McNerty & Co	277 3d Avenue	46.5	84	118
195	20	C. Helmes	212 E. 22d	47	82	114
196	21	—— McDonald	163 3d Avenue	46.5	88	112
197	21	W. J. Burdett & Co	217 "	47	86	124
198	21	W. Hollweg	226 "	47	83	115
199	21	G. Zimmerman	394 2d Avenue	45	83	112
200	21	W. Frese & Co	318 E. 22d	47	78	111
201	21	R. Scherer	329 "	45	90	125
202	21	F. July	305 1st Avenue	46	98	130
203	21	Fred. Reinschmidt	334 "	46	81	112
204	21	—— Granzen	378 "	47	86	115
205	21	John M. Oest	383 "	46.5	80	124
208	21	R. Levy	85 8th Avenue	48.5	84	110
209	21	John Rodgers	124 "	47	97	124
211	21	F. Van Axte	160 "	47.5	91	117
212	21	P. Fitzpatrick	233 "	47	86	120
213	26	Geo. Duncan	765 "	47	85	120
214	26	J. Friedlander	738 "	47.5	90	122
215	26	Mrs. E. Benton	717 "	48	89	110
218	26	M. Willis	572 "	47	86	120
219	26	Richard Taylor	440 "	46	90	117
220	26	John D. Leith	402 "	47	90	112
221	26	W. Thoden	382 "	47	86	114
222	26	John Barrett	372 "	47	95	118
223	26	John McKeon	289 "	47	92	124
225	26	Herman Kemna	325 W. 25th	45	92	123
227	26	George Peace	86 W. Houston	46	84	113
228	26	Emila Bernard	99 "	46.5	96	126
231	26	F. Schroeder	165 Prince	48	79	110
232	26	C. Hildebrandt	109 Thompson	46	97	124
233	26	D. Block	177 Spring	47	85	116
235	26	Martins & Siemers	130 Wooster	46.5	91	118
236	30	C. Fink	183 Laurens	46	90	120
238	30	H. Fideldy	221 Thompson	47	84	117
239	30	H. Bierman	213 Wooster	44.5	90	122
240	30	Wm. Wedemayer	202 "	47	87	110
242	30	Jos. Hundt	169 "	46	82	120
243	30	Geo. Rebers	170 "	46.5	86	116
244	30	R. Willenburg	42 W. Houston	46.5	79	106
245	30	Herman Fein	22 E. Houston	47	77	110
249	30	H. König	33 Prince	46	85	116
250	30	H. Bartling	48 "	46	85	114
251	30	H. O'Brian	49½ "	47	93	116
252	30	Heinken & Offerman	60 "	46.5	93	120
253	30	John Gallaghar	60½ "	46	90	118
254	30	N. Rose	56 Spring	47	82	118
255	30	F. Schierhorst	46 "	46	86	116
256	Sept. 2	G. H. Rodgers	667 7th Avenue	45.5	93	117
257	2	M. Porkridge	1495 Broadway	46	85	110
258	2	J. Widder	574 7th Avenue	43	88	118
259	2	J. Helenken	560 "	47	86	116
260	2	P. Tracey	554 "	46	84	112
261	2	Thomas O'Neil	497 "	46	93	120
262	2	Werner Mitchell	475 "	46	84	116
263	2	Lewis Biehl	458 "	45.5	92	122
264	2	P. Kettle	414 "	46	93	116
265	2	J. Geo. McKoere	321 "	46	88	110
266	2	L. Kohlmann	262 1st Street	46	90	116

My assistants were M. Alsberg, Ph. D.; H. Endemann, Ph. D.; and Mr. Müller.

Table I.—Kerosene Oils, safe by Both Tests.

Number.	DATE.	DEALER.	STORE.	Specific Gravity. Deg. Beaumé.	Flashing-point. Dog. Fahr.	Burning-point. Dog. Fahr.
79	....	—— Downer................	Boston......	46.1	109	128
113	....	....	180 9th Avenue.................	47.5	100	115
138	Aug. 13......	J. W. Hadfield..............	128 Myrtle Avenue, Brooklyn....	47	108	120
143	11......	C. Brehm....................	736 8th Avenue.................	48	100	112
151	12......	Mrs. Douglas................	1381 Broadway..................	47	104	124
152	12......	J. W. Stott.................	1388 "	47.5	104	117
192	20......	C. W. Frielin...............	397 2d Avenue..................	44	114	159
206	24......	P. Mangles..................	98 8th Avenue..................	47	100	126
207	24......	J. B. Hughes................	119 "	47	104	134
210	24......	Reinhardt & McIntyre.......	140 "	47	101	128
216	24......	P. Shanegood................	671 "	42	109	130
234	26......	H. P. Mayer.........	109 Laurens....................	45	104	132
285	Sept. 4......	W. Spliedt..................	216 Waverley Place.............	45.5	103	134
427	27......	J. Schmidt..................	202 Avenue C....................	44	100	130
428	25......	J. Barkley..................	14 "	45	124	157
429	23......	W. Rettig...................	57 Avenue B....................	47	114	143
461	Oct. 3......	—— Schlott..................	70 1st Street..................	49.5	100	136
513	Nov. 4......	Wm. Honerkamp...............	489 E. Houston	45	108	140
586	Dec. 9......	Dietrich Block..............	177 Spring.....................	44.5	100	128
610	24......	John F. Mills...............	58 Eldridge....................	45	130	152
626	31......	Fred. Jung..................	207 Forsyth....................	45.5	100	122

Table II.—Oils below Legal Standard by Flashing-test only.

Number.	DATE OF PURCHASE.	DEALER.	LOCALITY.	Specific Gravity. Deg. Beaumé.	Flashing-point. Deg. Fahr.	Burning-point. Deg. Fahr.
16	.. ..	.. .. ..	566 8th Avenue...................	45.1	58	110
23	.. ..	.. .. ..	88 Division Street...............	44.5	66	115
37	.. ..	.. .. ..	297 Houston......................	45.2	74	112
52	.. ..	.. .. ..	98 8th Avenue....................	45.1	79	114
56	.. ..	.. .. ..	722 2d Avenue....................	44.7	80	112
57	.. ..	.. .. ..	853 "	46	80	114
61	.. ..	.. .. ..	444 2d Street....................	45.4	80	113
63	.. ..	.. .. ..	15 Marion........................	45.1	82	115
64	.. ..	.. .. ..	104 Canal........................	45	83	112
66	.. ..	.. .. ..	697 3d Avenue....................	45.5	84	118
72	.. ..	.. .. ..	132 Mulberry.....................	44.2	88	117
74	.. ..	S. Jenny.....................	....	46.9	90	115
77	.. ..	.. .. ..	772 3d Avenue....................	45.5	94	113
78	.. ..	.. .. ..	761 "	46	94	113
90	.. ..	.. .. ..	55 Rose..........................	43.5	96	114
108	.. ..	.. .. ..	220 W. 16th......................	45	93	118
112	.. ..	.. .. ..	21 Clark.........................	45	96	110
129	Aug. 10......	J. Hefferman.................	142 Atlantic Street, Brooklyn....	47.5	94	115
130	10......	Wm. Lee......................	59 " " "	48.5	87	110
132	10......	W. H. Lewis..................	86 Court " "	47.5	84	111
133	10......	Semonite Bros................	78 Fulton " "	47	86	114
141	11......	H. Hartman...................	508 9th Avenue...................	47	88	117
147	12......	H. Groppe....................	54th Street and 8th Avenue......	48.5	84	110
150	12......	G. Pratt.....................	687 6th Avenue...................	47	84	110
153	12......	Allen Cummings...............	10th Avenue and 30th Street....	47.5	90	112
154	12......	Geo. T. Green................	102 W. 30th......................	47	96	110
155	14......	R. McFatherson...............	365 10th Avenue..................	47	90	112
159	14......	Tom Neely....................	78 "	47	92	121
164	14......	H. Lohman....................	427 "	47	94	114
166	16......	Browning & Berry	183 9th Avenue...................	47	90	110
167	16......	Jacob Fink...................	249 "	47	84	113
168	16......	Ph. Gokenholz................	86 "	46.5	92	118
169	16......	Mrs. Fyffe...................	98 "	47	86	118

Oils below Legal Standard by Flashing-test only—(Continued.)

Number.	DATE OF PURCHASE.	DEALER.	LOCALITY.	Specific Gravity. Deg. Beaumé.	Flashing-point. Deg. Fahr.	Burning-point. Deg. Fahr.
170	Aug. 16	W. Clark	217 9th Avenue	48	84	110
172	18	E. H. Hiners	247 "	48	92	114
173	18	N. R. Bodine	292 "	48	88	118
174	18	E. Rosenberg	296 "	47.5	92	128
175	18	E. H. Hannerhurst	325 "	47.5	90	118
176	18	James Farrar	425 "	47.5	89	118
177	18	W. Prede	451 "	48	91	115
178	18	H. & H. Brian	426 "	47	95	126
179	20	L. Mesmer	463 "	47.5	91	112
180	20	J. Bernard	469 "	47	84	116
181	20	J. Bertrand	483 "	47	85	117
183	20	John F. Rempe	523 "	43	93	126
184	20	Mrs. Diettmar	541 "	46	90	129
186	20	—— Boyle	278 3d Avenue	49	94	126
187	20	G. Hojer	302 "	47.5	97	130
188	20	R. McGarrity	334 "	48	76	110
189	20	W. Rathjen	365 "	47.5	85	117
191	20	D. Leopold	402 2d Avenue	46.5	89	118
193	20	E. C. Stoppenhagen	379 "	44.5	91	122
194	20	Wm. McNerty & Co	277 3d Avenue	46.5	84	118
195	20	C. Helmes	212 E. 22d	47	82	114
196	21	—— McDonald	163 3d Avenue	46.5	88	112
197	21	W. J. Burdett & Co	217 "	47	86	124
198	21	W. Hollweg	226 "	47	83	115
199	21	G. Zimmerman	394 2d Avenue	45	83	112
200	21	W. Frese & Co	318 E. 22d	47	78	111
201	21	R. Scherer	329 "	45	90	125
202	21	F. July	305 1st Avenue	46	98	130
203	21	Fred. Reinschmidt	334 "	46	81	112
204	21	—— Granzen	378 "	47	86	115
205	21	John M. Oest	383 "	46.5	80	124
208	21	R. Levy	85 8th Avenue	48.5	84	110
209	21	John Rodgers	124 "	47	97	124
211	21	F. Van Axte	160 "	47.5	91	117
212	21	P. Fitzpatrick	233 "	47	86	120
213	26	Geo. Duncan	765 "	47	85	120
214	26	J. Friedlander	738 "	47.5	90	122
215	26	Mrs. E. Benton	717 "	48	89	110
218	26	M. Willis	572 "	47	86	120
219	26	Richard Taylor	440 "	46	90	117
220	26	John D. Leith	402 "	47	90	112
221	26	W. Thoden	382 "	47	86	114
222	26	John Barrett	372 "	47	95	118
223	26	John McKeon	289 "	47	92	124
225	26	Herman Kemna	325 W. 25th	45	92	123
227	26	George Peace	86 W. Houston	46	84	113
228	26	Emila Bernard	99 "	46.5	96	126
231	26	F. Schroeder	165 Prince	48	79	110
232	26	C. Hildebrandt	109 Thompson	46	97	124
233	26	D. Block	177 Spring	47	85	116
235	26	Martins & Siemers	130 Wooster	46.5	91	118
236	30	C. Fink	183 Laurens	46	90	120
238	30	H. Fideldy	221 Thompson	47	84	117
239	30	H. Bierman	213 Wooster	44.5	90	122
240	30	Wm. Wedemayer	202 "	47	87	110
242	30	Jos. Hundt	169 "	46	82	120
243	30	Geo. Rebers	170 "	46.5	86	116
244	30	R. Willenburg	42 W. Houston	46.5	79	106
245	30	Herman Fein	22 E. Houston	47	77	110
249	30	H. König	33 Prince	46	85	116
250	30	H. Bartling	48 "	46	85	114
251	30	H. O'Brian	49½ "	47	93	116
252	30	Heinken & Offerman	60 "	46.5	93	120
253	30	John Gallaghar	60½ "	46	90	118
254	30	N. Rose	56 Spring	47	82	118
255	30	F. Schierhorst	46 "	46	86	116
256	Sept. 2	G. H. Rodgers	667 7th Avenue	45.5	93	117
257	2	M. Porkridge	1495 Broadway	46	85	110
258	2	J. Widder	574 7th Avenue	43	88	118
259	2	J. Helenken	560 "	47	86	116
260	2	P. Tracey	554 "	46	84	112
261	2	Thomas O'Neil	497 "	46	93	120
262	2	Werner Mitchell	475 "	46	84	116
263	2	Lewis Biehl	458 "	45.5	92	122
264	2	P. Kettle	414 "	46	93	116
265	2	J. Geo. McKoere	321 "	46	88	110
266	2	L. Kohlmann	262 1st Street	46	90	116

Oils below Legal Standard by Flashing-test only—(Continued.)

Number.	DATE OF PURCHASE.	DEALER.	LOCALITY.	Specific Gravity. Deg. Beaumé.	Flashing-point. Deg. Fahr.	Burning-point. Deg. Fahr.
267	Sept. 2	Malchon Bros	1 2d Avenue	45	94	125
268	2	A. Schulte	11 1st Avenue	45	89	116
269	2	Adam Ritter	223 E. Houston	46	93	113
270	2	H. Thiel	22 Avenue A	46	96	116
272	3	J. D. Luhmen & Bros	188 7th Avenue	46	92	112
274	3	John Otten	166 "	46	90	117
275	3	Thomas B. Crottin	316 "	46	93	112
276	3	D. Ficken	278 "	46	92	116
278	3	C. Rader	116 "	46	88	114
280	3	H. Barlach	243 "	45.5	92	114
283	3	W. J. Acker	21 "	46	88	113
284	4	—— Goldschmidt	72 Greenwich Avenue	46	90	123
286	4	—— Kaufman.	26 Charles	46	95	123
287	4	J. W. Schroeder	33 Christopher	46	90	114
288	4	H. Reineck	170 Waverley Place	46	92	114
289	4	H. F. Luhrs	141 "	46.5	84	114
290	6	Ferling & Grey	210 Sullivan	43	83	116
292	6	Michael Bremer	4 6th Avenue	47	81	116
293	6	A. P. Smith	4th and Cornelia	47	83	116
295	6	B. Jonnetan	128 8th Street	47	92	116
297	6	John H. Stalljess	151 6th Avenue	46	91	123
315	8	R. Milking	144 E. Houston	46	98	127
316	8	M. Kohl	175 Orchard	46	90	119
317	8	M. Johns	162 "	46	88	116
318	10	H. Sturke	265 Bleecker	46	85	114
319	10	Henken & König	283 "	44.5	84	112
320	10	H. Kugler	366 "	46	94	124
321	10	D. Siedenburg	552 Hudson	46.5	96	126
322	11	J. M. Bradler	689 6th Avenue	46	80	114
323	11	E. H. Tewers	636 "	47	86	120
324	11	Jos. Hannen	488 "	46	94	120
325	11	J. C. Ollerich	476 "	47	94	118
326	11	Fred. Schäfer	460 "	46.5	80	114
327	11	Mrs. Leary	125 W. 30th	47	88	114
328	11	T. Bolan	115 "	46	88	126
329	11	Smith & Son	924 3d Avenue	46.5	90	122
330	11	R. Kaufmann	871 "	46	86	120
331	11	J. Kane	833 "	46.5	87	116
332	11	Mrs. Young	763 "	47	90	116
333	11	John Dunkak	739 "	44.5	79	114
334	11	E. Gehben	20 2d Avenue	47	84	120
335	11	W. Bohnenkamp	37 "	47	90	121
336	11	R. Dierking	53 "	46	87	114
353	13	Riese Bros	83 St. Mark's Place	46	79	111
354	13	Peter Hoffmann	98 1st Avenue	46	88	118
355	13	A. Schultz	96 "	45	85	118
356	13	D. Rummel	60 "	46	90	120
357	13	H. Mahlstadt	28 "	46.5	86	118
358	13	H. Vorrath	42 Stanton	44.5	94	128
359	15	G. C. Edwards	675 3d Avenue	44.5	77	124
360	15	D. Dunley	610 "	46	85	116
361	15	John Denning	565 "	47	85	112
362	17	R. Shulz	96 1st Avenue	45	76	112
363	17	R. Oppenheimer	118 "	45.5	89	119
364	17	H. Klenke	146 "	46.5	84	119
365	17	R. Hannemann	192 "	47	84	114
366	17	Geo. Frolich	194 "	46	88	123
367	17	R. Worster	202 "	46	82	120
368	17	A. Spielman	220 "	46.5	95	118
369	17	M. H. Kampen	281 "	47	86	114
370	17	Braase & Bros	341 "	45.5	96	128
371	18	—— Zimmermann	394 2d Avenue	46.5	82	115
372	18	E. C. Stoppinhagen	379 "	42	97	122
373	18	E. Wehrenberg	361 "	45.5	79	119
374	18	Brandis & Klee	302 1st Avenue	46	86	121
375	18	Jos. Smith	249 "	45	81	112
376	21	Jos. Rose	130 E. 8th	46	77	115
377	21	M. Orschiedt	188 Avenue A	46.5	77	112
378	21	L. Gluck	215 "	46	92	125
404	23	James R. Weeb	229 & 230 West	47	86	118
405	21	Jos. Rehacek	182 Avenue B	47	86	118
406	21	R. Landrogt	208 "	45	91	126
407	21	—— Greenbaum	216 "	47	85	116
408	21	G. Dunlop	243 "	46	89	117
409	21	H. Bohlin	251 "	46	86	120
410	21	H. & J. Thiel	20 Avenue A	46	87	118
411	21	J. Frey	99 "	45.5	93	126

Oils below Legal Standard by Flashing-test only—(Continued.)

Number.	DATE OF PURCHASE.	DEALER.	LOCALITY.*	Specific Gravity. Deg. Beaumé.	Flashing-point. Deg. Fahr.	Burning-point. Deg. Fahr.
412	Sept. 21	Jos. Schlerling	27 Avenue A	47	81	115
413	23	N. Rossmann	25 Avenue B	47	90	112
414	23	Chas. Silz	34 "	46	84	118
415	23	A. Kraestner	63 "	46	86	113
416	23	W. Mayer	90 "	46	82	110
417	23	—— Lederer	99 "	46.5	90	118
418	25	H. Kraft	43 Avenue C	46.5	91	116
419	95	Jacob Heller	61 "	45.5	81	116
420	25	R. Brien	87 "	47	80	110
421	27	H. F. Peter	170 "	45.5	90	112
422	27	Henry Mayer	108 Avenue D	46	82	112
423	27	—— Trilling	103 "	46	92	124
424	27	—— Kinken	74 "	46	87	115
425	27	R. Shortalls	266 E. 6th	46.5	97	119
426	27	F. Bohde	20 Avenue D	47	90	118
441	30	Chr. Helms	212 E. 22d	46.5	88	113
442	30	D. von Müller	230 "	46	95	114
443	30	—— Wollmer	245 "	47	89	114
444	30	Freese & Co	318 "	47	88	117
445	30	J. H. Hanekamp	227 E. 21st	46.5	87	114
453	Oct. 6	Straus & Co	16 2d Avenue	46.5	86	115
454	6	Wm. Kipp	47 1st Street	47	86	110
455	6	Allen Kent	347 E. 17th	46	82	112
456	6	—— Reilly	405 "	47	88	112
457	6	Thomas Gaff	407 "	46.5	83	111
458	6	A. Redegeld	409 "	47	84	112
459	6	—— Perry	421 "	45	90	125
460	6	—— Scheurmann	424 "	46.5	82	111
481	12	—— Bartscher	436 E. 15th	45	96	122
482	12	—— Williams	342 Bowery	45	92	116
483	15	—— Clark	78 E. 3d	46	95	116
484	15	Aug. Gulde	110 "	45	84	111
485	15	—— Dieterich	116 "	46	92	110
486	15	L. A. Betsch	166 "	46.5	95	116
487	23	Mauer & Hermann	113 "	46	86	110
488	23	Zeno Rebig	121 "	47.5	90	112
489	23	Franc Chrastil	187 "	47.5	84	112
505	28	Abraham Reinheimer	332 E. Houston	45	90	110
506	Nov. 2	Henry Newman	249 Elizabeth	46	79	110
507	2	Thomas Murphy	229 "	45.5	94	112
508	2	Bridget Donohue	212 "	46	86	113
509	2	John Sperveslage	14 Prince	44.5	86	122
510	2	Chas. Berg	178 Elizabeth	45	88	121
511	4	Auguste Schiller	479 E. Houston	45	88	114
512	4	N. F. Boese	Lewis and E. Houston	45	86	110
515	15	J. Geyer	115 Ridge	46	84	113
521	13	Chr. Nevejans	149 Mott	45.5	84	118
522	13	John McLaughlin	99 E. 4th	46	81	112
523	13	Henry Ott	148 "	46	90	114
524	13	Mueller & Kayser	145 "	45.5	80	120
525	13	Henry Fahrenholz	110 "	45	92	119
526	13	Lewis Jelinek	160 "	46	90	116
529	15	Marcus Marten	197 Greene	47	92	122
530	15	Mary Felicine	209 "	47	90	114
531	15	Henry Behrmann	213 Wooster	47	82	114
532	15	Wm. Wedemayer	202 "	47.5	86	114
533	15	John Murken	Wooster and Bleecker	43	88	138
534	15	Hermann Teschmacher	175 Wooster	46	92	110
542	Dec. 2	Wm. Dasbeck	95 W. Houston	45.5	88	116
543	2	Caspar Depler	142 Laurens	46.5	90	112
544	2	Mary Sheridan	138 "	46.5	87	112
545	Nov. 25	Chas. H. Blohm & Co	142 Prince	47	84	111
546	25	J. R. Urner	129 Bleecker	46.5	84	112
547	25	Auguste Zimmermann	149 Thompson	46	88	122
548	25	Lewis Betjemann	191 Prince	47.5	86	114
564	25	Fred. Heine	113 Sullivan	47.5	82	110
565	25	Mrs. Ann Morral	111 "	48	85	110
566	29	Ferling & Grey	210 "	46	85	112
567	29	H. Havemayer	212 Bleecker	46	88	112
568	29	Isaac T. Wilkinson	36 Carmine	46	86	120
569	29	Jacob W. Luhrs	11 Bedford	46.5	86	114
570	Dec. 2	Julius Wolf	190 Grand	47	82	112
571	2	John Bremer	12 Spring	45.5	83	114
572	2	Mortimer Sullivan	40 "	45	89	112
573	2	Nicholas Roes	56 "	44	95	118
574	2	Chas. Doscher	64 "	44.5	84	110
582	9	Henry Bullenkamp	74 "	47	72	110

Oils below Legal Standard by Flashing-test only—(Continued.)

Number.	DATE OF PURCHASE.	DEALER.	LOCALITY.	Specific Gravity. Deg. Beaumé.	Flashing-point. Deg. Fahr.	Burning-point. Deg. Fahr.
583	Dec. 9......	John Biermann..............	92 Greene........................	45	87	110
584	9......	Henry Jager............ ...	157 Spring........................	47	86	110
585	9......	Geo. Diersing..............	164 "	45	92	118
592	16......	Wm. A. Lemke..	682 Greenwich.....................	46	92	110
593	16......	Schemmer & Busch..........	649 Washington....................	46	88	116
594	16......	John Brandt................	89 Morton.........................	47	94	120
605	16......	John Luhrs.................	37 Madison........................	47	78	110
606	16......	Freder. Otten..............	88 James..........................	46	82	112
607	16......	Henry Brummer.............	100 Roosevelt.....................	45.5	94	110
608	16......	Patrick O'Grath............	54 "	45.5	94	122
609	24......	Joseph Deller..............	48 Eldridge.......................	45	96	132
625	31......	Henry Brubacher............	169 Forsyth.......................	46	84	110
634	Jan. 7......	Andrew Trabert.............	418 E. 15th.......................	45	96	110
635	7......	Henry Sirter...............	426 "	46	88	112
636	7......	John Farell................	437 "	46	92	110

Table III.—Oils below Legal Standard by both Tests.

Number.	DATE OF PURCHASE.	DEALER.	LOCALITY.	Specific Gravity. Deg. Beaumé.	Flashing-point. Deg. Fahr.	Burning-point. Deg. Fahr.
1	.. ..	.. .. ..	40 E. Broadway..................	71.4	18	18
2	.. ..	.. .. ..	72 Bayard Street................	49	31	44
3	.. ..	.. .. ..	494 Grand.......................	46.6	40	60
4	.. ..	.. .. ..	331 W. 44th.....................	46.3	45	60
5	.. ..	.. .. ..	200 6th Avenue..................	47.2	45	65
6	.. ..	.. .. ..	47 Houston......................	48.2	45	63
7	.. ..	.. .. ..	216 Canal.......................	47.9	48	64
8	.. ..	.. .. ..	822 2d Avenue...................	50.2	49	72
9	.. ..	.. .. ..	1,855 3d Avenue.................	46.7	51	68
10	.. ..	.. .. ..	164 Avenue C....................	47.6	52	61
11	.. ..	.. .. ..	5 Pike..........................	47.4	53	61
12	.. ..	.. .. ..	104 Avenue D....................	48.5	54	103
13	.. ..	.. .. ..	655 7th Avenue..................	45.8	57	100
14	.. ..	.. .. ..	548½ 9th Avenue.................	48.1	58	87
15	.. ..	.. .. ..	107 Division....................	46.4	58	83
17	.. ..	.. .. ..	665 8th Avenue..................	45.5	59	78
18	.. ..	.. .. ..	793 1st Avenue..................	46.9	61	67
19	.. ..	.. .. ..	104 Division....................	46.6	62	92
20	.. ..	.. .. ..	111 Mulberry....................	46.2	65	97
21	.. ..	.. .. ..	556 8th Avenue..................	45.3	66	83
22	.. ..	.. .. ..	10th Avenue and 54th street.....	45.2	66	93
24	.. ..	.. .. ..	689 6th Avenue..................	45.9	66	98
25	.. ..	.. .. ..	454 3d Avenue...................	45.6	66	85
26	.. ..	.. .. ..	21 Mott.........................	45.8	69	87
27	.. ..	.. .. ..	290 Grand.......................	48.8	69	89
28	.. ..	.. .. ..	63 E. Broadway..................	45.6	71	103
29	.. ..	.. .. ..	122 Canal.......................	44.5	71	113
30	.. ..	.. .. ..	48 Prince.......................	46.7	71	104
31	.. ..	.. .. ..	779 1st Avenue..................	45.7	71	98
32	.. ..	.. .. ..	641 2d "	46.9	72	88
33	.. ..	.. .. ..	427 Grand.......................	45.8	72	108
34	.. ..	.. .. ..	1,917 3d Avenue.................	46.1	72	98
35	.. ..	.. .. ..	1,381 Broadway..................	45.9	73	97
36	.. ..	.. .. ..	5 Chatham Square................	45	73	89
38	.. ..	.. .. ..	1,890 3d Avenue.................	46.2	74	97
39	.. ..	.. .. ..	333 Bowery......................	44.8	74	101
40	.. ..	.. .. ..	211 Avenue B....................	45.8	75	94
41	.. ..	.. .. ..	899 2d Avenue...................	45.5	76	707
42	.. ..	.. .. ..	747 2d "	45.2	77	105
43	.. ..	.. .. ..	490 7th "	43.8	77	104
44	.. ..	.. .. ..	67 Mott.........................	46	77	108
45	.. ..	.. .. ..	269 Bowery......................	44.6	77	96
46	.. ..	.. .. ..	81 Mercer.......................	45.3	77	108
47	.. ..	.. .. ..	722 11th Avenue.................	45.3	77	96

Oils below Legal Standard by both Tests.—(Continued.)

Number.	DATE OF PURCHASE.	DEALER.	LOCALITY.	Specific Gravity. Deg. Beaumé	Flashing-point. Deg. Fahr.	Burning-point. Deg. Fahr.
48	.. ..	.. .. ..	Cor. 7th Avenue and 17th Street.	45.4	78	99
49	.. ..	.. .. ..	40 Houston	45.5	78	102
50	.. ..	.. .. ..	155 Goerck	48.8	78	104
51	.. ..	.. .. ..	74 3d Avenue	45.6	78	99
53	.. ..	.. .. ..	Cor. 7th Avenue and 16th Street.	46.7	79	105
54	.. ..	.. .. ..	129 6th Avenue	45.9	79	100
55	.. ..	.. .. ..	912 2d "	46.3	79	103
58	.. ..	.. .. ..	113 Mercer	45.9	80	101
59	.. ..	.. .. ..	49 Avenue D.	45.7	80	103
60	.. ..	.. .. ..	45 Mott	45.1	80	106
62	.. ..	.. .. ..	108 Mulberry	45.4	81	109
65	.. ..	.. .. ..	562 9th Avenue	45	84	104
67	.. ..	.. .. ..	728 3d "	44.7	85	101
68	.. ..	.. .. ..	57 Division	45.1	85	105
69	.. ..	.. .. ..	160 8th Avenue	45	86	105
70	.. ..	.. .. ..	322 10th "	45.9	86	99
71	.. ..	.. .. ..	633 2d "	45.9	87	92
73	.. ..	.. .. ..	808 2d "	45.2	89	107
75	.. ..	.. .. ..	860 2d "	45.5	90	106
76	.. ..	.. .. ..	550 Grand	46.3	90	108
80	.. ..	.. .. ..	97 W. Houston	70	..	44
81	.. ..	.. .. ..	40 E. Broadway	67.5	..	48
82	.. ..	.. .. ..	2 Pike	70	..	48
83	.. ..	.. .. ..	144 Avenue A.	67.5	..	48
84	.. ..	.. .. ..	174 Essex	41	78	92
85	.. ..	.. .. ..	64 E. Houston	44.5	90	108
86	.. ..	.. .. ..	134 Norfolk	43.5	97	108
87	.. ..	.. .. ..	70 Bayard	44.5	87	98
88	.. ..	.. .. ..	516 Grand	44	72	97
89	.. ..	.. .. ..	13 Roosevelt	44.5	78.5	106
91	.. ..	.. .. ..	39 Elm	45	86	98
92	.. ..	.. .. ..	30 Ludlow	62	..	60
93	.. ..	.. .. ..	25 Canal	71	..	60
94	.. ..	.. .. ..	98 4th, Williamsburgh	70.5	..	65
95	.. ..	.. .. ..	12 Greenwich	45.5	75	90
96	.. ..	.. .. ..	793 1st Avenue	45	77	98
97	.. ..	.. .. ..	149 Eldridge	46	75	106
98	.. ..	.. .. ..	48 Clinton	45	82	98
99	.. ..	.. .. ..	232 W. 16th	46.5	75	97
100	.. ..	.. .. ..	252 Monroe	45	89	107
101	.. ..	.. .. ..	Grand near Centre	65.5	..	60
102	.. ..	.. .. ..	75 Division	44.5	76	99
103	.. ..	.. .. ..	339 E. 46th	45	82	106
104	.. ..	.. .. ..	432 E. 11th	45	78	96
105	.. ..	.. .. ..	416 3d Avenue	44.5	90	109
106	.. ..	—— Devoe	— Fulton	45	92	106
107	.. ..	.. .. ..	" "	45	91	108
109	.. ..	.. .. ..	101 Hudson	45.5	76	94
110	.. ..	.. .. ..	218 Spring	46	89	108
111	.. ..	.. .. ..	212 "	46	80	104
114	July 30	—— Gettle	203 W. 26th	45	81	87
115	Aug. 2	—— Goddard	E. 75th, bet. 1st & 2d Avenues	46	77	90
116	July 31	.. .. ..	408 W. 26th	70	..	70
117	31	—— Moran	139 W. 19th	70	..	68
118	Aug. 2	—— Kelly, Agent	116 Maiden Lane	47.5	78	90
119	July 31	.. .. ..	264 W. Houston	46	82	90
120	31	.. .. ..	204 Varick	46.5	81	88
121	Aug. 4	—— McFarlan, Agent	Bank and West	47	86	98
122	9	Mrs. Sullivan	77 Water, Brooklyn	46.5	87	104
123	9	—— Richard	44 Main, "	47	82	95
124	9	J. H. Brown	51 Front, "	48	90	104
125	9	—— Lavarge	2 York, "	47.5	90	105
126	9	—— Wallace	7 Prospect, "	47.5	86	108
127	9	—— Schmall	Front & Washington, Brooklyn	47	88	103
128	9	J. C. Hourand	Main & Front, "	49.5	..	75
131	9	T. Warburton	123 Court, "	49	90	108
134	9	G. Rodgers	Cumberland St., bet. Park and Myrtle Avenues, Brooklyn	69	..	76
135	13	.. .. ..	Duffield St. & Myrtle Av., B'klyn.	68	..	80
136	13	—— Bussing	193 Schermerhorn, "	47.5	76	91
137	13	H. F. Harris	Dekalb & Hudson Avs., "	47	83	96
139	13	John Faraday	429 Atlantic Street, "	46.5	83	107
140	13	James Rorke & Co	233 Fulton Avenue, "	46.5	81	103
142	11	J. W. Stott	1,388 Broadway	48	80	98
144	11	G. J. Rode	688 (old number) 9th Avenue	47	88	108
145	11	William E. Benton	639 8th Avenue	47.5	89	105
146	12	M. Willis	540 8th "	48	78	101

Oils below Legal Standard by both Tests.—(Continued.)

Number.	DATE OF PURCHASE.	DEALER.	LOCALITY.	Specific Gravity, Deg. Beaumé.	Flashing-point, Deg. Fahr.	Burning-point, Deg. Fahr.
148	12	M. Moore	943 6th Avenue	48	84	106
149	12	F. Krake	815 6th "	47	86	108
156		James L. Vhelan	25th Street and 10th Avenue	46	78	108
157		H. Frey	96 10th Avenue	49	76	90
158		A. Meinhardt	132 10th "	46.5	82	104
160		T. O. Sullivan	137 10th "	47.5	78	102
161	16	C. T. Corner	27th Street and 10th Avenue	46.5	89	102
162	16	M. Schmades	368 10th Avenue	47.5	80	98
163	16	F. Buck Brothers	386 10th "	47.5	82	106
165	16	H. Kroger	456 10th "	49	84	96
171	16	M. Brummings	129 9th "	47	86	108
182	20	J. Hartman	507 9th "	48	82	107
185	20	Fred. Boshan	563 9th "	48	78	108
190	20	R. Wehrenberg	421 2d "	47.5	83	109
217	26	Ph. Fritz	606 8th "	71	..	...
224	26	George Wartenburg	320 8th "	47	83	108
226	26	Mrs. Finley	363 W. 25th	47	82	102
229	26	H. Wehrmann	97 W. Houston	70	..	...
230	26	R. Zimmerman	149 Thompson	47	75	106
237	30	Fred. Medicus	204 "	47	84	108
241	30	John Murken	117 Bleecker	47	78	109
246	30	Claus H. Fein	71 E. Houston	47	78	105
247	30	Johan Sperveslage	14 Prince	47	82	104
248	30	Francis Murphy	27 "	47	85	108
271	Sept. 2	William Luckhardt	224 Chrystie	46	84	106
277	3	C. Brayton	124 W. 19th	43.5	85	102
279	3	Peter Ried	81 W. 28th	46	88	106
281	3	P. Hardiman	300 7th Avenue	46	78	104
282	4	C. H. Hinkin	78 7th "	46	86	108
291	6	—— Soholobaum	92 Amity	48	73	99
294	6	F. C. Rohr	58 6th Avenue	47	86	108
296	6	C. Valentine	105 W. 10th	47	78	103
298	8	D. Schneider	138 E. Houston	47	77	106
299	8	Charles Denten	180 E. "	47	86	109
300	8	M. Kreitzer	181 E. "	47.5	83	106
301	10	A. E. Hey	247 Bleeker	49	85	108
302	10	Peter Breen	251 "	46.5	79	106
303	10	Fred. Lohmann	212 "	50	77	98
304	10	R. Schreibmüller	328 "	46	83	109
305	10	John Blohm	240 W. 10th	47	81	106
306	11	Cowen & Co.	687 6th Avenue	47.5	74	98
307	11	Charles Wellner	500 6th "	46.5	82	108
308	11	Mrs. Bohlan	119 W. 30th	46.5	78	106
309	11	William Lausen	915 3d Avenue	46	83	104
310	11	H. Fuelling	875 3d "	48	78	107
311	11	H. Michael	798 3d "	45.5	82	107
312	11	J. C. Batjeman	777 3d "	47.5	76	101
313	11	Louis Fist	741 3d "	46.5	79	108
314	11	John Bohling	34 2d Avenue	49	72	98
337	17	Loeber & Vogler	166 Johnson, Brooklyn	63	..	...
338	18	F. Bloum	56th Street and 5th Avenue	70	..	...
339	19	J. W. Ufer	162 Avenue A.	69	..	...
340	15	—— Morse	709 3d Avenue	47	79	104
341	15	R. Jaeger	633 3d "	47	79	108
342	15	J. G. Gerdes	521 3d "	50	76	103
343	17	H. F. Ohmeis	93 1st "	46	76	103
344	17	C. Wolfert	275 1st "	47	77	97
345	17	F. July	305 1st "	47	77	107
346	18	D. Leopold	402 2d "	47	82	105
347	18	C. W. Frieling	397 2d "	47	82	109
348	18	Mrs. Smith	261 1st "	47	80	105
349	18	F. Abinger	149 Avenue A.	49	76	90
350	18	B. Rabe	169½ " "	46	82	104
351	18	D. Ward	192 " "	47	72	98
352	18	John Thiel	207 " "	47	76	98
379	27	Kohlhaase & Beck	331 E. Houston	70	..	...
380	21	W. S. Wood	174 Avenue B.	48	73	95
381	21	Jos. Lederer	228 " "	47	77	108
382	21	L. Meinhardt	224 " "	46.5	85	108
383	22	F. Mohr	50 " A.	46	83	108
384	22	M. Stern	104 " "	48	76	96
385	22	F. Hyde	47 " "	46	80	106
386	22	John Dals	43 " "	47	78	108
387	22	H. Wood	103 1st Street	48	72	88
388	23	J. Hoffmann	100 Avenue B.	47	77	98
389	23	Charles Schafer	194 E. 2d	47	70	100
390	23	T. Haas	29 Avenue C.	47	80	105

Oils below Legal Standard by both Tests.—(Continued.)

Number.	DATE OF PURCHASE.	DEALER.	LOCALITY.	Specific Gravity. Deg. Beaumé.	Flashing-point. Deg. Fahr.	Burning-point. Deg. Fahr.
391	23	Mrs. Quentzer	65 Avenue C	47	77	101
392	23	Riss & Brothers	69 " "	47	76	99
393	25	M. H. Michael	85 " "	47.5	81	107
394	27	L. Beekman	113 " "	45	83	103
395	27	J. Corrigan	177 " "	47	77	100
396	27	Laurence Manann	185 " "	46	86	105
397	27	Mrs. Nevan	215 " "	46	82	100
398	27	George German	148 " "	45	87	105
399	27	R. Ritz	191 E. 7th	46	83	108
400	28	C. Harms	94 Avenue D	47.5	69	101
401	28	J. C. Owens	51 " "	47	76	97
402	28	H. Schmelke	40 " "	46.5	80	109
403	23	George W. Todd	64 Dey	47	72	104
430	30	Jacob Becker,	225 E. 22d	47	86	105
431	30	P. Murphy	232 E. "	47.5	80	107
432	30	John McIntyre	337 E. "	46.5	86	107
433	30	P. Boyle	332 E. "	46	80	108
434	Oct. 4	B. Connell	329 E. 21st	47.5	72	99
435	4	Mrs. Herzog	342 E. "	47.5	71	96
436	4	—— McDonald	335 E. "	47	77	101
437	4	Martin Lid	344 E. 20th	47	82	103
438	4	J. Reisen	407 E. 19th	49	..	68
439	4	—— Salje	427 E. "	50	..	68
340	4	P. F. Flynn	354 E. "	47.5	72	92
446	4	—— Gerben	20 2d Avenue	49	69	84
447	5	—— Romer	32 1st Street	47	80	106
448	5	Martin Grosshardt	37 1st "	47	85	105
449	5	Lewis Kihle	99 1st "	47	85	104
450	5	—— Schulte	11 1st Avenue	47	84	105
451	6	Mrs. Barbara Gensheimer	429 E. 17th	47.5	71	89
452	6	John Blappert	429 E. "	47.5	74	100
462	12	—— Zimmermann	410 E. 15th	46.5	86	109
463	12	Mrs. Merkel	418 E. "	50	..	67
464	12	—— Schnier	420 E. "	45	87	108
465	12	William Rice	423 E. "	46	87	100
466	12	—— Achembon	427 E. "	46.5	92	100
467	12	—— Kurtz	429 E. "	45.5	78	98
468	12	—— John	Ewen and Johnson, Brooklyn	66	..	60
469	12	Smith & Co	177 Ludlow	72	..	60
470	12	G. L. Smith	40 E. Broadway	69	..	60
471	19	J. W. Ufer	162 Avenue A	69	..	60
472	15	—— Froge	81 E. 3d	46	70	94
473	15	—— Kirchmann	122 E. 3d	47	76	103
474	15	—— Reichert	152 E. "	46	81	109
475	23	—— Rothaug	170 E. "	46.5	83	106
476	23	—— Schwartz	131 E. "	46.5	80	106
477	23	—— Reiter	129 E. "	46	80	109
478	23	John Newseys	131 E. " (old number)	47	74	102
479	23	—— Reichert	152 E. "	45.5	86	107
480	23	John Bronnstedter	183 E. "	47	86	107
490	28	George Haman	238 E. Houston	45.5	88	108
491	28	Joseph Schreiner	299 E. "	44.5	86	109
492	28	Nathan Reichenberg	315 E. "	46	80	103
493	28	Moritz Beck	331 E. "	46.5	86	108
494	28	Theodore Kirsch	358 E. "	46.5	78	104
495	28	Charles Sottong	380 E. "	46	82	100
496	28	Henry Morgenstein	392 E. "	45	82	105
497	Nov. 2	George Springmayer	242 Elizabeth	47	92	108
498	2	Merkel Gery	218 "	46	84	106
499	2	Benjamin Reiners	172 "	46	76	106
500	4	Gustave Koch	393 E. Houston	46.5	79	106
501	4	Bracken & Ivers	406 E. "	66	..	65
502	4	J. A. Handsuch	444 E. "	47	79	106
503	4	Joseph Wuest	462 E. "	46.5	87	107
504	4	James Vanduzer	449 E. "	48.5	..	55
514	10	J. Geyer	115 Ridge	68	..	62
516	12	R. C. Kayser	62 William	47	68	90
517	16	" "	62 "	47	68	93
518	13	John Walker	122 E. 4th	45	79	98
519	13	John Fred. Schmidt	107 E. "	45.5	86	108
520	13	Mrs. Ann Behen	101 E. "	46	81	98
527	15	Herman Budelmann	209 Green	48	80	109
528	15	Joseph Hund	169 Wooster	46	82	100
535	22	C. Golden	180 Laurence	47	86	104
536	22	Charles Fink	183 "	47	80	100
537	22	George Viage	86 W. Houston	47.5	84	106
538	22	John C. Rottmann	145 Prince	46.5	86	106

Oils below Legal Standard by both Tests.—(Continued.)

Number.	DATE OF PURCHASE.	DEALER.	LOCALITY.	Specific Gravity. Deg. Beaumé.	Flashing-point. Deg. Fahr.	Burning-point. Deg. Fahr.
539	25	R. C. Kayser	142 Maiden Lane	48	80	98
540	25	Henry Thole	106 W. Houston	46	93	108
541	25	Lewis Ohl	105 W. "	48	78	100
549	25	Fred. Sanderfield	84 Sullivan	47.5	80	104
550	25	John H. Schlobohm	92 Amity	48	77	97
551	25	John H. Rosonbaum	230 Sullivan	47	78	100
552	29	Fred. Mayer	49 Carmine	47	76	106
553	29	Hans Clippert	34 Downing	48	86	100
554	29	.. .. ..	378 Grand, Williamsburgh	75	..	14
555	Dec. 2	Robert Herbert	Melrose	46.5	90	108
556	2	—— Legrange	Mariner's Harbor	47.5	79	92
557	2	Cullen, King & McGoey	143 Maiden Lane	47	84	102
558	3	Martin Raine	164 Grand	46	84	102
559	3	John Mullenbrink	13 Spring	46	85	106
560	3	Fred. Schierhors	46 "	46.5	86	105
561	3	Mrs. Jane Anderson	214 Mulberry	46.5	85	106
562	3	John Gallagher	62 Spring	46.5	86	104
563	3	.. Lamp Store	78 Ridge	46	78	102
575	9	Theodore Finken	127 Spring	46.5	84	106
576	9	Charles H. Martin	139 "	47	80	106
577	9	Daniel Verdenhalven	142 "	46	77	101
578	9	R. C. Kayser	62 William	47	67	93
579	9	Mrs. Gallagher	Burned to death at 17 Charles	74	..	63
580	9	J. D. Rapelyea	Greenwich Avenue and 12th	75	..	57
581	9	J. W. Ufer	24 Spring	69	..	62
587	10	Henry Guiken	700 Washington	46	76	92
588	10	John M. Eichinger	731 Greenwich	43.5	78	104
589	10	Henry De Witt	716 "	45.5	82	107
590	10	C. L. & E. G. Jachne	270 Spring	46	60	100
591	10	Duncan Miller	357 Hudson	46.5	88	108
595	1	M. J. McCullock	68 James	46	80	106
596	1	Andrew Farber	73 "	45.5	76	92
597	1	Arend. Bavendam	329 Water	46	77	102
598	1	John Pyne	336 "	46.5	82	102
599	4	Gustav Buergal	45 Eldridge	48	86	108
600	4	William Miller	51 "	46.5	84	102
601	4	Henry Knade	169 "	46.5	78	98
602	4	Henry Horstmann	78 "	46.5	84	102
603	4	Henry Krenich	75 "	46	72	98
604	8	Hermann Strauss	72 "	44	66	106
611	30	William Luckhardt	224 Chrystie	46	74	98
612	30	Peter Schilo	218 "	47	74	98
613	30	George Bork	214 "	47	82	103
614	30	Henry C. Langhaar	25 Stanton	47	78	98
615	30	Hugh Gannon	19 "	47.5	74	102
616	30	John Pohley	201 Chrystie	47	72	104
617	30	Anton Hartmann	187 "	46.5	82	109
618	30	John Dressler	182 "	47	74	94
619	31	George Behr	204 Forsyth	45.5	72	100
620	31	William Glaub	199 "	46.5	70	98
621	31	Belty Hagemann	188 "	45.5	86	102
622	31	Henry Daes	165 "	47.5	78	98
623	31	Fred. Vamhofe	32 Rivington	46	82	104
624	31	John D. Mayer	18 "	45.5	90	108
627	31	Adam Bischoff,	430 E. 15th	46	89	109
628	31	Bernhard Kurtz	429 E. "	47	78	102
629	31	Francis Jelin	427 E. "	47	78	100
630	31	McDonald Brothers	161 3d Avenue	46.5	76	100
631	31	W. G. Burdett & Co	217 3d "	47	86	106
632	Jan. 8	Mrs. Bower	199 Rivington	45	72	103
633	11	Richard Pudelmann	198 "	45.5	78	102

The twenty-nine oils which were found to be naphtha or benzine, are included in Table III. As they evolve explosive vapors at all ordinary temperatures, the exact temperature at which they begin to give off these vapors could not be determined; hence the blanks in the column for "flashing point." Their specific gravities also betray their character.

PROSECUTIONS.

The Attorney of the Board was directed to commence suits against those who were found to sell oil below the standards of safety fixed by the ordinance, and about one hundred cases were made out and tried before one of the Civil Justices. But *his Honor* finally threw them all out of court, without giving any opinion upon them. The Board has directed that the cases be appealed to a higher court. At present, therefore, the sale of dangerous kerosene is not in any way prevented.

INVESTIGATIONS BY THE FIRE COMMISSIONERS.

Soon after the publication of the results of the investigations made by the officers of the Board of Health, the Fire Commissioners caused about three hundred samples of kerosene to be purchased and tested, with results in every way in accord with our own. Nothing, however, was ever done by them to prevent the sale of the dangerous oils.

ACCIDENTS.

The terrible accidents continue to occur, though, since the public has been so earnestly cautioned by the Board of Health, they do not seem to occur as frequently as formerly. Several heart-rending accidents have occurred in the Metropolitan District during the past year.

Fire-Marshal Brackett reports during the year ending October 31, 1869—

Total fires in New York	913
Fires caused by kerosene	98

This is equal to seventeen per cent. The damage to property by the kerosene fires was $72,720.

In Brooklyn during the same period—

Total fires	311
Fires caused by kerosene	31

Equivalent to ten per cent.

During the year 1869 I cut from the one morning and one evening paper which I regularly read, the records of—

Deaths from kerosene accidents	52
Serious injuries	50
Slight injuries	6
Total	108

In 37 cases there was considerable damage to property; in 11, slight damage.

One notable feature of these accidents is the fact that the victims are generally women or children.

LEGISLATION.

The subject of dangerous kerosene is receiving considerable attention wherever this cheap and beautiful material is in use.

In 1867 the Legislature of Maine passed a general law regulating the sale of kerosene, which was amended in 1868. No oil or burning-fluid can be sold in the State, unless it will stand a fire-test of at least 120° Fahrenheit.

The following is an abstract of the law above referred to, and which is now in force in that State:

Section 1 relates to the appointment of inspectors in every city and town of 2,000 inhabitants or over, whose duties it shall be to inspect all such burning oils and fluids, and cause each vessel or cask to be marked with date of inspection, degree of fire-test, and inspector's name.

Section 2 relates to the marking of casks of inspected oil as unsafe, and defines the punishment of dishonest inspectors by a $500 fine or six months' imprisonment in the county jail.

Section 3 relates to imperative requirement of the law that the manufacturer of such oils and fluids shall cause every cask or vessel to be inspected, and the fire-test marked thereon, as demanded by section first. If any one shall make or sell any uninspected oil or fluid, or any marked unsafe, he shall be punished by a fine of $500 or six months in the county jail.

Section 4 relates to the same points as in section three, except it applies the law to sellers as section three does to manufacturers, who are also sellers.

Section 5 declares all prosecutions under the second, third, and fourth sections, shall be by indictment.

Section 6 relates to the power of selectmen of towns, and the mayor and aldermen and police of cities, to examine all oils and cause them to be inspected, and when the law is violated to enforce the prosecution of offenders.

Section 7 declares the date of the law taking effect on and after June 1, 1867.

Two or three bills have been introduced into Congress, but I believe it has been decided that the matter can be regulated by the State or municipal authorities only. In February, 1870, a general order was promulgated from the War Department, which provides that hereafter no volatile oils will be issued or used for illuminating purposes at military posts, and all varieties of coal-oil will be regarded as volatile. In general, lard-oil will be supplied.

In England, as early as 1862, a law was enacted by Parliament regulating the safe-keeping of petroleum. This law fixes the test by pronouncing all oils dangerous which *give off an inflammable vapor at a temperature of less than one hundred degrees of the Fahrenheit thermometer.*

In 1868 the act was amended, and the following schedule of directions for applying the test was incorporated in the amended law:

DIRECTIONS FOR APPLYING THE FLASHING-TEST TO SAMPLES OF PETROLEUM-OIL.

The vessel which is to hold the oil shall be of thin sheet-iron; it shall be two inches deep and two inches wide at the opening, tapering slightly toward the bottom; it shall have a flat rim, with a raised edge one-quarter of an inch high around the top; it shall be supported by this rim in a tin vessel four inches and a half deep, and four and a half inches in diameter; it shall also have a thin wire stretched across the opening, which wire shall be so fixed to the edge of the vessel that it shall be a quarter of an inch above the surface of the flat rim. The thermometer to be used shall have a round bulb, about half an inch in diameter, and is to be graduated upon the scale of Fahrenheit, every ten degrees occupying not less than half an inch upon the scale.

The inner vessel shall be filled with the petroleum to be tested, but care must be taken that the liquid does not cover the flat rim. The outer vessel shall be filled with cold, or nearly cold, water; a small flame shall be applied to the bottom of the outer vessel, and the thermometer shall be inserted into the oil so that the bulb shall be immersed about one and a half inches beneath the surface. A screen of pasteboard or wood shall be placed round the apparatus, and shall be of such dimensions as to surround it about two-thirds, and to reach several inches above the level of the vessels.

When heat has been applied to the water until the thermometer has risen to about 90°

Fahrenheit, a very small flame shall be quickly passed across the surface of the oil on a level with the wire. If no pale-blue flicker or flash is produced, the application of the flame is to be repeated for every rise of two or three degrees in the thermometer. When the flashing-point has been noted, the test shall be repeated with a fresh sample of the oil, using cold, or nearly cold, water as before; withdrawing the source of heat from the outer vessel when the temperature approaches that noted in the first experiment, and applying the flame-test at every rise of two degrees in the thermometer.

The provisions of the present law are not considered sufficiently stringent, and it is said Parliament will now amend the law of 1868.

NEW YORK STATE.

The following bill is now before the State Senate:

AN ACT TO PROVIDE AGAINST KEROSENE ACCIDENTS IN THE CITIES OF NEW YORK AND BROOKLYN.

The People of the State of New York, represented in Senate and Assembly, do enact as follows:

SECTION 1. It shall not be lawful for any person, firm, or company, in the cities of New York and Brooklyn, to deal in, sell, or give away, any refined petroleum, kerosene, or other burning-fluid, at retail, or in less quantities than five barrels, for illuminating purposes in any dwelling-house, store, shop, restaurant, car, coach, or other vehicle, unless such article shall stand a fire-test of not less than one hundred and ten degrees (110°) Fahrenheit, as indicated by the most improved pyrometer. No person, firm, or company, shall deal in, sell, or give away, any refined petroleum, kerosene, or other burning-fluid, without taking out a license therefor, which license shall be granted for one year by the mayor of the respective city, upon payment of the sum of ten dollars for each license, a certificate of which shall contain the name of the person, firm, or company, and the precise place at which the business is to be carried on: the certificate shall be posted in some conspicuous place upon said premises. The funds so collected shall be deposited in the City Treasury.

SECTION 2. The Mayor of the City of New York shall, within ten days after the passage of this act, appoint three Inspectors, and the Mayor of the City of Brooklyn shall, within the same time, appoint two Inspectors. The Inspector shall hold office at the will of the Mayor, and shall receive an annual salary of not more than three thousand dollars, payable from the funds derived from the issue of licenses, in monthly payments, by order of the Mayor upon the City Treasurer. It shall be the duty of the Inspector, when called upon by any vender, purchaser, or other reputable person, or whenever he has good reason to suspect any violation of the provisions of this act, to inspect and test any refined petroleum, kerosene, or other burning-fluid, by the most improved instrument. The Inspector shall be entitled to receive from the person at whose request he shall make such examination, the sum of twenty-five cents for each cask, barrel, can, or other vessel inspected. From the sums so collected, the Inspector shall be paid for expenses incurred in carrying out the provisions of this act, and the remainder shall be paid over to the City Treasury.

SECTION 3. Any person violating any of the provisions of this act shall, upon complaint of the Inspector, be subject to arrest by warrant of Court or Magistrate, and shall, upon trial and conviction, pay a penalty of not less than one hundred dollars, and not more than five hundred dollars. And in case death ensues from any violation of the provisions of this act, the party offending shall be deemed guilty of a felony, and subject to a fine of not less than one thousand dollars, and not more than five thousand dollars, or imprisonment for not less than one year nor more than five years; the fines to be paid into the Treasury of the city where such conviction shall be had.

SECTION 4. This act shall take effect immediately.

There are several very serious objections to this bill, and, while any law which is intended to control and regulate the sale of kerosene, should receive the hearty support of all good citizens, it is to be hoped this bill will receive some important amendments before it becomes a law.

1. It should be made general. It should apply to every city, town, and village, in the State. It is specially needed in the country, as every one there is compelled to burn kerosene, often without any choice of dealers from whom to purchase it.

2. The *burning-test* is not the best test; the *flashing-test* is the one that should be exclusively relied upon in testing oils. The accidents arise generally from the *vapors* which escape from the oil, and which, by mingling with the air, produce explosive mixtures. Two or three per cent. of naphtha may make an oil highly dangerous in this respect, so that it will flash below 100° F., and yet its burning-point may be above 110° F. Two hundred and eighty of the specimens which we tested would pass for safe oils under this law, and yet every one of them flashed below 100° F., and was liable to produce an explosion. The English law relies entirely upon the flashing-point, which is fixed at 100° F.

In Section I., the following words should be changed, "*unless such article shall stand a fire-test of not less than one hundred and ten degrees* (110°) *F., as indicated by the most approved pyrometer*," and made to read "*which shall evolve a combustible vapor at a temperature below one hundred* (100°) *degrees of the Fahrenheit thermometer*."

3. The following provision should be included in the law: "*it shall not be lawful for any person, firm, or company, to deal in, sell, or give away any* petroleum, or product of petroleum, kerosene, or other oil, which emits a combustible vapor at a temperature below (100°) one hundred degrees of the Fahrenheit thermometer, except each package of the same be labelled in clear and distinct characters, '*highly dangerous*, liable to *explode below* 100° *Fahrenheit*.'" And it shall not be lawful to label, mark, or dispose of such article under any name which can lead persons to suppose that it is intended for burning in lamps.

4. Three inspectors are entirely unnecessary for the city of New York. The positions would soon become mere sinecures. It would not be necessary to enforce the law a dozen times, to fine a few dealers, and send one or two to prison for from one to five years, to drive dangerous kerosene entirely out of the market. An inspector, if he knows his business, can easily, with one assistant, test in the most careful manner, thirty or forty samples a day; or say ten thousand per annum. I am confident five hundred or one thousand tests, if the law was properly enforced, would drive the unsafe oils entirely out of the State.

5. The law seems to make the prosecution of offenders entirely optional with the Inspector, for it says, Section III., "any person violating any of the provisions of this act, shall, *upon complaint of the Inspector*, be subject to arrest by warrant of court, or magistrate," etc.

This will be a very dangerous power to put into the hands of the inspectors. It will give them an opportunity to test oils, and to compound felonies without limit, in the quietest and most profitable manner possible.

The law should be made general, *let the crime be defined*, and then let every one be entitled to enter a complaint, and simply require proof as to the flashing of the oil below 100° F. Every one should be entitled to come into court and prove, by competent experts, the dangerous character of the oil. The Inspectors should not constitute the only prosecutors, nor the only competent witnesses.

We want a law which will give us the fullest protection against kerosene accidents; and, especially, do we desire to avoid placing any person in a place so thickly beset with temptations as the office of an inspector under the proposed bill.

TESTING KEROSENE.

The operation of testing kerosene is very simple. It is merely ascertaining the temperature at which the oil evolves an inflammable vapor, *the flashing-point*, and the temperature at which the oil takes fire, *the burning-point.* But when I say the operation is very simple, I do not mean to say that any person is qualified to make the test in a reliable manner until he has been properly instructed. In careless, ignorant hands, results may deviate twenty or thirty degrees from the truth; while in skilful hands a margin of four or five degrees will cover the most divergent results.

1. A suitable apparatus is required; the tester described in the schedule of the English patent law is a very good one; the *open tester* of J. Tagliabue is a very good instrument, but should be protected from currents of air, when in use, by a screen. The *closed* tester, or "*pyrometer*," I consider very unreliable, as the mass of metal which is exposed, is very liable to become heated by the burning vapor, after the flashing-point has been reached. The result of this is the igniting of the overheated petroleum at the surface, long before the thermometer records its actual temperature. I have seen the oil ignite while the thermometer stood twenty degrees below its proper burning-point.

2. The oil should be heated very slowly; a test should never be completed in less than fifteen minutes, and when the oil flashes or burns but a few degrees from the standard temperature, it is hardly safe to spend less than twenty-five to forty minutes in raising the temperature of the oil to the flashing-point. Whenever the test is to be used in a prosecution against the dealer, it should be duplicated with special care. The length of time occupied depends, of course, on the size of the flame beneath the tester.

3. The thermometer should not descend far below the surface of the oil; if the bulb is well covered, it is sufficient. There is often a difference of a number of degrees in the temperature of the oil at different depths. It is well to stir the oil before applying the flame.

4. Care should be taken in making the test to use a very small flame for trying the oil. I have used with entire satisfaction a minute gas-flame, burning from a glass tube drawn to a fine point; as this is attached to a burner by a rubber tube, it is perfectly flexible. This flame should not be thrust against the surface of the oil in making the flashing-test, as it might by heating the oil cause it to flash a number of degrees below the proper point.

Respectfully submitted:

C. F. Chandler, Ph. D.,

Chemist to the Metropolitan Board of Health.

THE GAS NUISANCE.

REPORT OF THE CHEMIST OF THE BOARD ON GAS PURIFICATION, WITH A HISTORY OF THE GAS NUISANCE IN NEW YORK.

Colonel Emmons Clark, *Secretary of the Metropolitan Board of Health.*

Sir: In answer to the resolution of the Board of Health, directing the Chemist to make a statement *in extenso* of the methods of purification employed by the several gas companies of New York, I have the honor to submit the following report:

I.—METHODS OF PURIFICATION IN GENERAL USE.

The crude gas which is produced by the exposure of bituminous coal to a bright-red heat, in clay or iron retorts, is freed, during its passage through the hydraulic main, the condenser, and the washer, from the tar which it contains, and from a portion of its water and ammoniacal compounds. It still contains, however, objectionable impurities, which must be removed by a process of purification. These are sulphuretted hydrogen, sulphide of ammonium, cyanide of ammonium, sulphocyanide of ammonium, bisulphide of carbon, certain other sulphur compounds whose exact nature is not known, and carbonic acid. The sulphur compounds are all very objectionable; they give the gas a very offensive smell, and when burned produce sulphurous acid, which, if evolved in any considerable quantity, would quickly render the air of a room unfit for human life, and seriously injure furniture and goods exposed to its action. These sulphur compounds must, therefore, be removed. The carbonic-acid gas is objectionable only in so far as it diminishes the illuminating power of the gas when present in appreciable quantities. There is no sanitary objection to carbonic acid; for perfectly-purified gas would produce, when burned, a great many times as much carbonic acid as exists in the most impure crude gas. The presence of ammonia in gas in appreciable quantities is objectionable; but as all the methods of purification, at present used, remove the compounds of ammonia very effectually, we may confine the discussion to the sulphur compounds and the carbonic acid. There are four methods of purifying gas now in use.

1. *The Wet-Lime Process.*

This process involves passing the gas through milk of lime. It is the oldest process in use, and is very effective in removing both the sulphur compounds and the carbonic acid. It has been generally abandoned, however, on account of the difficulty of disposing of the foul milk of lime, called "blue billy." Occurring as a liquid, the "blue billy" is not easily transported; and as it does not rapidly undergo oxidation, it is not well adapted for use as a fertilizer. Running it into rivers and streams has been forbidden by law, as the pollution of the waters by it was intolerable, while the extremely offensive smell which it emits makes it impossible to store it until it becomes dry enough for transportation.

2. *The Dry-Lime Process.*

In this process dry or slightly-moist hydrate of lime is placed on trays in iron boxes, through which the gas is made to pass. This process is very effective, and has very generally superseded the wet-lime process. It removes the sulphur compounds and the carbonic acid equally well. When the foul lime is removed, however, it evolves the same odor which caused the wet-lime process to be abandoned. When exposed to the air it rapidly undergoes oxidation, becoming heated in consequence. During this process it evolves sulphide of ammonium, and some other compounds whose exact nature is not known, but whose odor is extremely offensive. This is the cause of the "gas nuisance" so loudly complained of a few years ago, when all the New York companies employed this process of purification. After the oxidation of the foul lime is completed it ceases to be specially offensive, the peculiar stench being evolved during the first hour or two of exposure. The offensiveness of this foul lime became such a constant cause of complaint in the large cities of Europe that the gas companies were compelled to abandon the process, as they had previously abandoned the wet lime. A system of ventilating the foul lime has been invented and is now in use at both the stations of the Manhattan Company in this city, which effects its oxidation in such a manner that the offensive gases evolved are not permitted to escape into the atmosphere, but are passed through a washing apparatus and finally through a special purifier, by which they are rendered comparatively inoffensive. This invention seems to obviate the nuisance of dry-lime purification.

3. *The Laming Process.*

In 1849 Mr. Laming introduced the hydrated sesquioxide of iron as a substitute for lime for purifying gas, preparing it of a suitable quality by mixing copperas (sulphate of iron) with slacked lime and sawdust, and exposing the mixture to the air to oxidize the protoxide of iron to the sesquioxide. The resulting mixture contains hydrated sesquioxide of iron, sulphate of lime, and sawdust.

When an excess of hydrate of lime is employed the resulting mixture contains this substance also. This material is very effective in removing the sulphur compounds from the gas. There is, however, some difference of opinion as to the completeness with which the carbonic acid is removed, due perhaps to variations in the proportions of the ingredients. Two important advantages attend the use of this mixture; first, when fouled it does not evolve offensive odors on exposure to the air; second, by exposure to air the sesquioxide of iron, which has been changed to sulphide of iron in the purifier, is regenerated, the sulphur being liberated and sesquioxide of iron again formed. The mixture may therefore be used again and again, till it becomes so clogged with the sulphur liberated that it does not act promptly on the gas. It is then found to contain from forty to sixty per cent. of sulphur, and may be used for the manufacture of sulphuric acid. I have seen mixtures which had been in use twelve months.

4. *The Iron-Ore Process.*

A few months after Laming introduced the artificial hydrated sesquioxide of iron in France, Mr. J. M. Hills applied the natural hydrated sesquioxide of iron, or "bog-iron ore," in England. This material, like the Laming mixture, may be used again and again, and does not evolve offensive odors when exposed to the air. A modification of this process is now used by the New York Gas-light Company of this city. It was invented by Messrs. St. John and Cartwright, and has been in use nearly two years, giving entire satisfaction. As the bog-iron ores of this neighborhood are not sufficiently pulverulent to act promptly on the gas, Messrs. St. John and Cartwright add to the ore a quantity of iron borings or turnings, which they then convert into an artificial hydrated sesquioxide of iron by moistening the whole with ammoniacal liquor and exposing it to the air. The resulting mixture of natural and artificial oxide receives an addition of coarsely-pulverized charcoal. This mixture is always sprinkled with ammoniacal water before it is placed in the purifier.

The material now in daily use at the works of the New York Gas-light Company was introduced in April, 1868. Occasional additions of iron borings have been made to it; otherwise the material is the same. When last tested it contained thirty per cent. of sulphur. In Germany several varieties of sesquioxide of iron are now in use, prominent among which are "the Oberuseler mixture," an iron-ore containing some oxide of manganese; the "Manheim oxide," and "Deicke's oxide," very pure artificial oxides of iron.

II.—EXTENT TO WHICH THE DIFFERENT METHODS OF PURIFICATION ARE EMPLOYED.

The wet-lime method has been almost entirely abandoned. The only works at which I know it to be used at present are at Cork, in Ireland. These works are of moderate size, and are situated out of the city. Moreover, the gas is freed from ammonia by means of sulphuric acid, before it comes in contact with the lime. The foul lime does not, therefore, evolve sulphide of ammonium when exposed to the air. The dry-lime process, though still in general use in this country, has been almost universally abandoned in Europe. Abandoned, firstly, because the foul lime was an intolerable nuisance; secondly, because the process is too expensive, as the lime can be used but once, and when exhausted has but a trifling value as a fertilizer.

The Laming mixture is now used in many of the European gas-works. All the gas supplied to Paris is purified by this material. The German gas engineers have found that this mixture owes its efficacy entirely to the oxide of iron which it contains, and that the sulphate and hydrate of lime present do not take any appreciable part in the purification. Hence they are abandoning this mixture for the natural or artificial oxides of iron, which are cheaper and more efficient.

The iron-ore method is now most generally used in Europe, and has obtained a foothold in this country, being used by the New York Gas-light Company in this city, as already described, and by two or three companies in Massachusetts. All the Liverpool gas; much, if not all, of the London gas, and that of most of the German cities, is now purified either by iron-ore or one of the artificial oxides of iron. As my statements with regard to the general use of iron in place of lime were called in question during the hearing before the Board of Health, I will state that they were fully confirmed by my observations in Europe during the past summer, and will quote two or three unimpeachable authorities. Dr. Schilling, director of the gas-works at Munich, and editor of the *Journal für Gasbeleuchtung*, says on page 247 of that journal for 1868: "Iron purification is now in general use." Mr. A. Buhe, who was one of the chemists employed by the German Gas Association to investigate the whole subject of gas purification, says, in the above-mentioned journal for 1868, page 327 *et sequitur:* "Gas engineers have sought by various means, especially by lime, to remove the carbonic acid from gas; but these have been generally abandoned on account of the cost and the numerous disadvantages which attend their use." . . . . "Purification by lime is hardly in use at the present time." Mr. G. R. Hislop, Engineer and Manager of the Paisley Gas Works, and President of the North British Association of Gas Managers, stated in his address at Glasgow, July 28, 1869: "Purification by lime in London and elsewhere has now become inadmissible; in such places oxide of iron is employed as the purifying agent."—(*Journal of Gas-Lighting*, 1869, p. 695.)

III.—COMPARATIVE ADVANTAGES OF THE DIFFERENT METHODS.

The lime methods effectually remove the carbonic acid, and reduce the sulphur compounds to a minimum. Were there no objections to the use of dry lime on the score of cost or offensiveness, I think this agent would be generally preferred. Lime was first abandoned on account of the nuisance which it occasioned, but the iron oxides are now actually preferred by the European gas-engineers on account of their greater economy. Mr. King, the engineer of the Liverpool works, assured me that the oxide-of-iron purification, which he had used exclusively for the past seven or eight years, cost less than half as much as the dry-lime process used previously.

Two objections are urged against the iron methods by those who are prejudiced in favor of lime. First, they do not remove carbonic acid; second, it is claimed that they do not remove the sulphur compounds as completely as lime.

The first is generally conceded to be true. But the only objection to carbonic acid is that it reduces the illuminating power of the gas. One per cent. of carbonic acid diminishes the illuminating power five per cent. The average quantity of carbonic acid is, say, two and one-half per cent.; then the illuminating power of the gas will suffer to the extent of twelve and one-half per cent., or one-eighth.

There are two ways in which this difficulty can be effectually met: First, by using better coals for making the gas, or adding a few pounds of rich cannel or some other enriching material to the ordinary gas-coals; or secondly, by taking less gas from the coal. The last gas drawn from the coal is always inferior to that which comes off first. Mr. A. Buhe, already referred to, says: "It has become more and more the custom to leave the carbonic acid in the gas, and to neutralize its bad influence on the illuminating power by taking less gas from the coal, thus getting a better gas." Dr. Schilling says: "Carbonic acid is of no consequence to the consumer; cannel coal is the remedy."

The second objection to the iron processes is the alleged imperfect removal of the sulphur compounds. None of the methods in use entirely remove the sulphur from the gas. The question arises, therefore, how much sulphur can be safely left in the gas. The English Parliament has answered this question by fixing the limit at twenty grains of sulphur to one hundred cubic feet of gas; and, to see that the companies come within this limit, chemists are appointed whose duty it is to analyze the gas and to report its quality. I have before me the report of Dr. Letheby for the months of January, February, and March, 1869. He states the grains of sulphur found in one hundred cubic feet of gas to be as follows:

	Maximum.	*Minimum.*	*Average.*
City of London Gaslight and Coke Company.	18.92	11.70	15.00
The Gaslight and Coke Company..........	24.15	15.75	19.49
Great Central Gas Consumers' Company.....	24.00	7.03	12.28

From this, it will be seen that the gas of London, although purified by iron, does not average twenty grains of sulphur in one hundred cubic feet. With regard to the Paris gas which is purified by Laming's oxide-of-iron mixture, Prof. J. Lawrence Smith, one of the United States Commissioners to the French Exposition of 1867, who is the president of the Louisville Gas Company, has given us a very decided opinion. On page 88 of his report, which was published by the United States Government, he says: "The gas of these works is most thoroughly purified, and the dealers in silks and other delicate fabrics who, a few years ago, always suffered more or less loss from the results of the combustion of impure gas acting on their fabrics, now no longer suffer from this cause."

Dr. Letheby (*Journal of Gas-Lighting*, 1869, page 83) has argued that twenty grains of sulphur should not be left in the gas, and proposes, therefore, as the most effective method of purifying gas, this treatment: first, with ammoniacal liquor; second, with hydrated oxide of iron; third, with dry lime. As the iron will have removed the sulphuretted hydrogen, the refuse lime will not be offensive, while it will effectually remove the carbonic acid. This system of purification will, he thinks, reduce the quantity of sulphur to ten or twelve grains per one hundred cubic feet. Most gas engineers and chemists differ from Dr. Letheby on this point, however. Dr. Schilling says, in his *Journal für Gasbeleuchtung* for 1869, page 484: "Twenty grains of sulphur in one hundred cubic feet of gas are entirely unobjectionable. Under the most favorable circumstances, with no ventilation whatever, it would give the atmosphere of a room only one part of sulphurous acid in 500,000 parts of air." Prof. William Odling, secretary of the London Chemical Society, has spoken very clearly on this subject in his lecture to the British Association of Gas Managers, June 2, 1868, which appears in the *Journal of Gas-Lighting* for 1869, page 81, and I have found that his views are those generally entertained by chemists and gas engineers. He said:

"I am altogether at issue with the public when they maintain that the sulphur of gas produces, by its combustion, oil of vitriol, or that the amount of sulphur ordinarily contained in gas, is of any consequence whatever; and a little consideration will, I think, satisfy you of the soundness of this position. We will assume that coal-gas contains not twenty, but forty grains of sulphur in 100 feet, a quantity, at any rate, greatly exceeding the reality. Now, making another extravagant assumption that the whole of these forty grains of sulphur would be completely burned, and, in reality, they would be burned very incompletely, they would furnish, by their combustion, eighty grains of sulphurous-acid gas. This quantity of the produced sulphurous acid would occupy, at ordinary temperatures, about one-fifteenth part of a cubic foot, and since 100 cubic feet of our coal-gas gives one-fifteenth of a cubic foot of sulphurous acid, 1,500 cubic feet of coal-gas would be required to furnish one cubic foot of the acid, even upon the extravagant assumptions we have purposely made. But the combustion of 1,500 feet of coal-gas would produce something besides sulphurous acid. It would produce at least 1,000 cubic feet of carbonic acid, and, in addition to its dilution by other gases and vapors, we should have our sulphurous acid diluted by 1,000 times its volume of carbonic acid. Now, if we can get at the proportion of carbonic acid in the atmosphere of a room highly illuminated with gas, and take the thousandth part of that proportion, we shall be able to form some notion of the amount of sulphurous acid present. You will remember that the amount of carbonic acid furnished by the breath of one individual is equal to that furnished by two three-feet gas-burners, and that the maximum amount of carbonic acid found in the atmosphere of a crowded theatre was 0.32 per cent. Now, if in addition to our previous unreasonable suppositions we further suppose that an atmosphere contains 0.2 per cent. of carbonic acid furnished by gas combustion, you will see that the whole matter becomes a *reductio ad absurdum;* that we might actually have one-half-millionth part of sulphurous acid present in the air of a gas-lighted room."

I think that the facts and opinions here quoted effectually dispose of the second objection to oxide-of-iron purification. It may seem that I have said more than was necessary on the comparative merits of the lime and iron processes of purification, but a perusal of the testimony given during the hearing before the Board will recall the fact that the evidence of the experts, called by the Metropolitan Gaslight Company, was almost entirely confined to this question. In fact, the defence offered was the alleged total failure of the iron processes, and the consequent unavoidable use of lime.

IV.—HISTORY OF THE GAS NUISANCE.

For years the citizens of New York have complained of a peculiarly offensive smell which was perceived throughout the city to a greater or less degree, according to the weather. This smell was noticed at particular hours of the day, and pervaded large districts, making it impossible to open the windows during its prevalence. By many this smell was attributed to the gases from the sewers, but it was easily demonstrated that the sewers did not, as they do not now, send out offensive gases. The enormous quantities of Croton water used throughout the city make it impossible for the sewers ever to become specially offensive. The smell was peculiar, and was recognized at once by every chemist, and by every one familiar with the manufacture of gas, as the smell of the foul lime which had been used for purifying gas.

The first special complaint against a gas company that I find on record, is that of Dr. E. H. Janes to the Board of Health, against the Manhattan Company, dated April 24, 1866, and printed in the annual report of the Board for that year. The subject was at that time referred to the Sanitary Committee. On the 30th of April following, a committee of the Citizens' Association conferred with the Sanitary Committee on the subject; Prof. R. O. Doremus and Prof. Samuel St. John appearing as members of the citizens' committee, and the gas companies being represented by some of their officers. As a result of this conference, the Manhattan and New York companies at once turned their attention to the subject, and sought means to prevent the nuisance which they admitted to exist. Nor were their efforts in vain. The Manhattan Company made a number of experiments with a view to destroying the foul gases of the refuse lime, and finally introduced the ventilating process which I have already alluded to, and which, with the improvements recently introduced, seems to effectually remedy the nuisance. The New York company was equally active, and after considerable investigation decided to give up lime purification altogether, and very judiciously introduced the oxide of iron in its place. Thus the largest companies on the island, which supply all the gas consumed below Thirty-fourth Street, promptly responded to the suggestions of the sanitary committee, and removed the cause of complaint. As these two companies manufacture four-fifths of all the gas produced on the island, and own all the gas-works situated below Forty-first Street, a great improvement was at once noticed.

The Metropolitan Company, however, which supplies gas to that portion of the city between Thirty-fourth and Seventy-ninth Streets, paid no heed to complaints of the citizens, but continued to send out the odors of foul lime. As this company does not manufacture more than one-fifth of the gas supplied to this city, the nuisance was not, however, as general as before. Its works are situated at the foot of West Forty-second Street, and the odors are often blown westward, away from the island. In certain kinds of weather, however, the smell was diffused throughout the city, and complaints were not rare. Some attempts were made to coerce the company, but all responsibility for the smell was stoutly denied by the officers. The members of the Board of Health were on the alert with a determination to compel the offending parties to follow the example of the other companies.

On July 5, 1868, Dr. Stephen Smith, Sanitary Commissioner, and Dr. Elisha Harris, Sanitary Superintendent, noticed the unmistakable smell of foul lime in Thirty-fourth Street. They consulted the neighboring vanes, and found that the wind was blowing from the northwest, and, walking in this direction, guided by the odor, they came to the Metropolitan Gas-Works in West Forty-second Street, when they found that a purifier had just been emptied, and the pile of foul lime was still warm and reeking with offensive gases. When these facts were reported to the Board of Health, an order was at once issued, dated July 14th, declaring the manufacture of gas at the foot of West Forty-second Street to be a nuisance, and ordering the same to be discontinued, except it be conducted by a process that will not allow any deleterious gases or odors detrimental to health to escape into the external air.

Mr. Zollikoffer, the president of the Metropolitan Company, at once requested an opportunity to be heard in defence of the company; and on August 10th he appeared by counsel and showed by his witness that he employed the best coals and purified by the best process, and that the gases evolved by the foul lime were any thing but unhealthy—were, indeed, a specific for the whooping-cough and other diseases. The Attorney for the Board of Health showed by his witness that the purification as conducted by the Metropolitan Company was necessarily a nuisance, but one that could be easily avoided by following the example of either of the other city companies. The hearing was then adjourned to August 13th. On that day the counsel presented a memorial from the gas company, signed by the president. In this they first plead the inexperience of youth, the company being the youngest on the island. They then state that they never heard it even suggested that purification by dry lime was in any way offensive till they received the order of July 14th. This is a somewhat remarkable statement, inasmuch as every book on gas-making admits the nuisance, and since the other companies had, two years previously, in response to the Board of Health, investigated the matter and made the necessary changes, all the particulars having appeared in the daily papers from time to time.

Further, while they protest against the adjudication of the Board of Health that their process of purification is a nuisance, they avow their willingness to try any method which science may suggest and experiment demonstrate to be a better one than that which they are using; and finally request that the hearing be postponed till March 1, 1869, that they may experiment on improved methods of purification. The Board finally consented to a postponement of several months.

On February 6, 1869, the hearing was resumed. The gas company had enjoyed a respite of nearly six months for this special object, and on a distinct written promise to make experiments; and had not actually made a single experiment during the entire period. One thing only had been done, they sent a man to Europe to learn what processes of purification were in use there. He had returned, but great care was taken, when the hearing was resumed, not to put him on the witness-stand, for his written report was a complete confirmation of all that had been claimed by the witness for the Board of Health with regard to the improved processes of purification there and for preventing nuisance. What did the Metropolitan Company do, then, after making written promises, and saying so much about good faith, etc.? They made no experiments; did not follow the advice of the man they had sent to Europe; did not do what either of the other New York companies had done to mitigate the nuisance, but at the end of six months appeared by counsel, with distinguished chemical experts, to defend the stench-producing method of purification. For several days the hearing was continued, and nearly two hundred printed pages of testimony taken.

I will do justice to Professor Silliman, who was called to testify by the gas company, by stating that, while we differed as to the expediency of introducing iron purification instead of lime, he stated clearly and unequivocally, on the cross-examination, that the process of purification as conducted by the Metropolitan Company was necessarily a nuisance, and that by using simple precautions this nuisance could be avoided. This was all that the Board of Health was called upon to prove, and the admission of this by their own witness was evidently understood by the gas company as equivalent to losing their case. So they presented another memorial, or, rather, a set of resolutions, in which they again proposed to experiment. This was on March 4th, and the hearing was then postponed till March 22d, the company solemnly stipulating to introduce and test the iron or some other improved process.

When March 22d arrived, the company again made excuses. "In order to introduce the iron process it was necessary to place false bottoms of perforated plank in the purifiers, and there was only one man in New York who could bore the holes, and he had been busy boring holes for some one else." Still, the patience of the Board of Health held out, especially as a prompt enforcement of the order of July 14th might have thrown into darkness all that portion of the city lying between Thirty-fourth and Seventy-ninth Streets. Finally, the gas company actually began to experiment, but in a very original way. They engaged a man to make a soap with which to wash the smell out of the foul lime. A considerable quantity of it was used, and the members of the Board of Health and several other gentlemen were invited to witness the success of the operation. But the soap did not answer; it was tolerably effective on the upper layer of foul lime, but left the lower five or six layers as offensive as ever.

At last an iron mixture was procured; not one of those, however, which the messenger to Europe had seen in successful operation, and minutely described in his written report; nor yet the one in use by the New York Gas-Light Company, but a mixture which was once used somewhere in New Jersey and subsequently abandoned; a mixture of Spanish brown, shell-lime, and sawdust. Half the purifiers were filled with this mixture, while the other set were filled with lime as usual. They went through the motions of using this mixture in half the purifiers during most of the past summer, though the gas was actually purified, I think, by the purifiers containing lime. At all events, the mixture did not work, as might have been expected; and this autumn, as soon as the consumption of gas increased, the mixture was thrown out and the purifiers were again filled with lime. So this company has now gone back to the old process, and, in spite of all the evidence to the contrary, and all the time and money expended in bringing out that evidence, it still stubbornly denies the fact that foul lime creates a nuisance, or that any improvements have been made in gas purification.

The offensive process is now in full operation, and, more than that, the foul lime is actually used to fill in a pier. This is specially objectionable, as it has already happened in both London and Dublin that, in making excavations for sewers in places where foul lime had been used for filling in, the workmen were killed by the gases evolved. Five men were killed at one time in this manner in London, in 1849.

Such is the history of the gas nuisance in New York, brought down to date.

V.—WHAT THE METROPOLITAN GAS COMPANY MIGHT DO.

This company has probably spent nearly $10,000 for expert fees, counsel fees, sending to Europe the man whose evidence was suppressed and whose advice was not followed, time of employés, printing two hundred pages of evidence, etc., all apparently with the design, not of suppressing the nuisance, but of defeating the honest efforts of the Board of Health in behalf of the citizens of New York. Suppose the officers of this company were really acting in good faith, with a sincere desire to obviate the nuisance, they could at once introduce a better process for purification, a cheaper process, by which they could save $10,000 per annum, or they could retain their present process and ventilate the foul lime. Let them follow the example of either of the neighboring companies, use the iron process of the New York Company, or the ventilating process of the Manhattan Company, or they may select any one of the improved iron processes now used in Europe. All that is asked of them is that they manifest the same willingness to direct their efforts to the management of their business in a manner most conducive to the health and comfort of the city, as was so promptly manifested by the other companies.

VI.—CHANGES REQUIRED.

The introduction of an iron process would require little if any change in the apparatus. Some iron mixtures are employed in exactly the same iron boxes with trays, as the company is now using for lime, while the greatest change that could be necessary would consist simply in taking out the movable trays and introducing a flooring of plank, perforated with augur-holes. A few hours would suffice to make the change; in fact, the plank flooring is already on the ground. A few days would be required to procure the necessary material. As there are two sets of purifiers, either of which could, in case of necessity, be made to purify all the gas made by the company, the change could easily be made without any serious interruption. Until within a short time, the New York Gas Company has been obliged to purify more gas than the Metropolitan Company now makes, with purifiers of no greater capacity than one of these two sets. To introduce the ventilating process, considerable additions would be required to the apparatus. A suitable engine, a blower, a washer, and a supplementary purifier for the air used in ventilating would be required, besides a considerable length of mains and the necessary connections. These additions would involve an outlay of several thousand dollars, and some months would be consumed in procuring and erecting them.

VII.—THE AMMONIA WORKS IN EIGHTEENTH STREET.

I cannot consider this report completed until I have referred to the peculiar odor which is evolved in West Eighteenth Street, and which is attributed by many to the Manhattan Gas Works. I refer to the odors which escape from the Ammonia Works in that street. The ammoniacal liquor of the Manhattan Works is sold to parties who manufacture from it ammoniacal salts. This liquor contains sulphide, cyanide, and sulphocyanide of ammonium, carbonate of ammonia, and various other compounds which are offensive, but whose exact nature is not known. With careful management the treatment of this liquor need not cause offence, but it is so conducted at these works as to send forth a very disagreeable odor, which is mistaken by persons not familiar with the business for the odor of foul lime. I have noticed this odor, at some distance from the works, almost every time I have visited the neighborhood. The proprietors of the works should be induced to modify their process in such a way as to prevent this nuisance.

SPECIMENS.

In conclusion, I beg leave to submit a few specimens of the bog-iron ore and oxide-of-iron mixtures, which I collected in Europe this summer, and which are now in actual use in Liverpool, London, Paris, etc.

Respectfully yours,
C. F. Chandler, Ph. D.,
Chemist to the Metropolitan Board of Health.

THE PROCEEDINGS IN REGARD TO THE GAS NUISANCE.

Order No. 425.

Office of the Metropolitan Board of Health,
No. 301 Mott Street, New York City.

At a meeting of the Metropolitan Board of Health, held on the 14th day of July, 1868, at said office:

The premises hereinafter named having been, and being in the opinion of said Board, and in fact, in a condition and in effect dangerous to life and health; and said Board having taken and filed among its records what it regards as being, and what is sufficient proof to authorize its declaration, that the same is a public nuisance, and dangerous to life and health; said Board does hereby enter the same on its records as a nuisance, and makes, in respect thereto, the following order, to wit:

Ordered, That the business of manufacturing (conducted by the Metropolitan Gas Company), at Foot of West Forty-second Street, be discontinued, except it be conducted by a process of manufacture that will not allow any deleterious gases or odors detrimental to health to escape into external air, and directs this order to be served as said law requires, and that, in case this order is not executed by the proper persons, the same be executed by the Board of Metropolitan Police; but that its execution be not commenced by the said Board of Metropolitan Police until the further order of this Board, of which further order no notice will be given to the parties interested.

As witness the signature of
EMMONS CLARK,
Secretary of Metropolitan Board of Health.

Suspension of Order and Notice of Hearing, under the First Clause of Section 14 of the Metropolitan Health Law, Chapter 74, of Laws of 1866.

Form No. 5. Order No. 11.

Office of the Metropolitan Board of Health,
No. 301 Mott Street, New York, *July* 29, 1868.

This Board having, on the 14th day July, 1868, made an Order (being Order No. 425) relative to the business of manufacturing gas at the foot of West Forty-second Street, New

York, and having declared the same to be a public nuisance, and to the general effect that the business of manufacturing gas (conducted by the Metropolitan Gas Company) at foot of West Forty-second Street, New York, be discontinued, except it be conducted by a process of manufacture that will not allow any deleterious gases or odors detrimental to health to escape into the external air; and the same having, on or about the 15th day of July, 1868, been served upon Oscar Zollikoffer, President of the Metropolitan Gas Company, being the proper party, and said Oscar Zollikoffer having requested the opportunity to be heard before this Board, which said clause of said section authorizes, the execution of said order is hereby suspended until the further order of this Board.

And notice is hereby given to the said Oscar Zollikoffer, who has requested an opportunity for a hearing, that he will be heard, and can present facts and proofs, as said law and the regulations of this Board provide, before this Board, at its office as above, on the 1st day of August, 1868, at 10 o'clock A. M. on that day, or as soon thereafter as said hearing can be had. Said applicant must take notice of the adjournments of this Board, and of its rules and regulations, and of its final Order in this matter, and must be prepared to proceed in said matter, at said time and place, and at any subsequent meeting, as the business of said Board will allow; and all without further notice, beyond the service of a copy hereof. As witness the signature of EMMONS CLARK,

Secretary of said Board of Health.

HEARING BEFORE THE REFEREE.

At a hearing before the undersigned, D. B. Hasbrouck, held at the office of the Metropolitan Board of Health, No. 301 Mott Street, New York, on the 1st day of August, 1868, in pursuance of the order and notice of the Metropolitan Board of Health, a copy of which is hereto annexed:

By consent of both parties the hearing was adjourned to August 5, 1868, at 10 o'clock A. M. No testimony was offered.

At the adjourned hearing, August 5, 1868, at same place, by consent of both parties a further adjournment was had to August 10, 1868, at 11 o'clock A. M. No testimony was offered.

At the adjourned hearing before the undersigned, D. B. Hasbrouck, held at the same place on the 10th of August, 1868, *Oscar Zollikoffer*, President Metropolitan Gas Company, appeared in person, and by *H. C. Van Vorst; the Metropolitan Board of Health, by H. C. Allen.*

TESTIMONY OF SAMUEL P. PARHAM, ASSISTANT-ENGINEER OF THE METROPOLITAN GAS-LIGHT CO.

SAMUEL P. PARHAM called for the Metropolitan Gas Company, being duly sworn, testifies as follows:

By Mr. Van Vorst: Q. Where do you reside? A. 354 West Forty-eighth Street.

Q. What is your business? A. Gas engineer, of a practice of twenty-six years, and all branches connected therewith.

Q. How long have you been connected with the Metropolitan Gas Company? A. Eight years, or nearly so, within a few months.

Q. In what capacity? A. As assistant engineer in constructing works, and afterward assistant engineer for the works of the Company.

Q. What are your duties as assistant engineer of the Company's works? A. My special duties in charge of the distribution outside the works, to assist the engineer when called upon inside to make any drawing, alteration, or extension.

Q. With what Company were you connected before you connected yourself with the Metropolitan Gas Company? A. Twenty years ago I was Superintendent of the Trenton Gaslight Company; afterward I was engineer, repairing works in different parts of the United States, and then in business until eight years ago, in business for myself.

Q. Connected with the Philadelphia Gas-Works? A. No, sir.

Q. With what other gas works have you been connected besides the Metropolitan and the Trenton? A. The York, Pennsylvania, Gas Works; consulting engineer at Pottsville, consulting engineer at Fredericksburg, Maryland, and at Columbia, South Carolina.

Q. Macon? A. No, sir. I was builder of the Trenton Water Works. That is outside the question, though.

Q. What had you to do with the process of manufacture of gas for the defendants? A. I had more particularly the distribution, and to take the engineer's place when absent; at the same time I overlooked every thing round the works for the company's interest.

Q. What coal does the Metropolitan Gas Company use for the manufacture of gas? A. They use different veins of coal, but all of the best quality. They use the best coals in the city of New York or in the United States; no better coals can be procured—Boghead, Cannel coal, Armiston coal, Lutheon, St. Hellen, Inchal, Lesmahago.

Q. Is this company particular about getting the best quality of coal, and that freest from injurious ingredients, out of which to make their gas? A. There is no company in the United States has better coal than the Metropolitan; it buys the best that can be purchased in the market; the Scotch cannel ranks the highest in the world, and we have it, and the bituminous holds the same rank.

Q. You import a good deal of coal? A. Yes, sir.

Q. Where are the company's works located? A. Forty-second Street and North River.

Q. The gas is manufactured there? A. Yes, sir.

Q. It is west of Eleventh Avenue? A. Yes, sir.

Q. Can you state how the gas of the Metropolitan Company is purified? A. Purified by what is called the dry-lime process.

Q. Now you may explain it.

A. It is the oyster-shell lime which is the best, because it is more like a powder; it is moistened, damped a little, and put into trays.

Q. You call them trays? A. Trays; we put them on purifying boards, sieves.

Q. This lime is put in these purifying boxes? A. Yes, sir.

Q. Describe the process. A. There are four purifiers, and the gas passes through three of these boxes at one time, and passes through the lime contained in these boxes; we test the quality of gas from time to time; there is no set time to change these boxes, but it is decided with a test paper; when it is shown that the gas is the slightest foul, then a new purifier is put on, and the old one is cleaned.

Q. How many boxes do you use? A. Four.

Q. Don't you use more than that? A. We have eight, that is two sets, four is a set.

Q. At certain seasons of the year you use them all? A. Yes, sir; in the winter.

Q. Now will you state, if you please, what office the lime performs in purifying the gas; what it disengages from the gas? A. It extracts the sulphuretted hydrogen gas, carbonic acid gas, whatever ammonia the water does not take out by the washers.

Q. Does the lime take out the ammonia? A. Whatever portion comes through retains a good deal of it; we depend more upon the washers for the ammonia and the condensers.

Q. It takes out those matters? A. From the gas; these are foreign matters we do not want; we want the illuminating matters.

Q. Do you know what becomes of them? A. Are detained in the lime.

Q. They enter into combination with the lime? A. Yes, sir.

Q. What does the lime become? A. It becomes foul, as we say.

Q. You say it enters into combination with the lime? A. In the washers it goes with the water and tar. The sulphuretted hydrogen and carbonic acid comes here combined with the lime; these are the principal gases which are contained.

Q. You say they are taken up upon the lime? A. Yes, sir; and contained by the lime.

Q. Do any of them go into the air, and if so, what? A. When the lime is exposed, I presume it does—when the foul lime is exposed.

Q. What goes into the air? A. The emanations from the lime—whatever has an affinity for the air, and the air has an affinity to pass off.

Q. What becomes of the lime? A. The lime is thrown into the yard, and then sold as a fertilizer.

Q. State when, and how often, the boxes are emptied? A. We have no set time for the boxes.

Q. I mean for this lime? A. Will say they run twenty-four hours during the winter, and during the summer, when our make is not very great, run two or three days before the boxes are changed.

Q. The lime is emptied? A. The lime is emptied—some coal contains more sulphur than others—the whole thing is a chemical counterbalance.

Q. Your effort is to get that coal which has the least sulphur? A. Yes, sir; it is the cheapest and best for the consumer.

Q. What becomes of the lime? A. The lime is taken out of the boxes and wheeled to the yard, and there it remains, or there it is conveyed upon vessels and carried to the country as a fertilizer.

Q. What agent is used in the purification of gas in the other works with which you have been connected? A. Lime; dry lime; I never used any other than dry lime.

Q. Have you had any experience in the use of any other agent except dry lime? A. No, sir; I have tried experiments with iron filings and potash, but they were mere experiments.

Q. When did you perform these experiments? A. It was twenty years ago, in Trenton, New Jersey, in 1848.

Q. How did they succeed? A. They made gas very brilliant, sir, but very expensive. It was mere laboratory experiments. Potash, iron filings, and sulphur. The sulphur need not have been there.

Q. Brilliant gas, but very expensive? A. The process was very expensive. It was too expensive for general use.

Q. Have you been at the New York Gas Works? A. Yes, sir.

Q. Lately? A. Last Wednesday, sir, I was there looking at the process of purifying. I was accompanied by Mr. St. John, one of the patentees. He explained to me all, I presume. I do not know that he kept any thing back.

Q. What agent do they use there for purification? A. Oxide of iron; iron filings I saw there and charcoal, and I think he damped it with ammoniacal liquor. If there was any thing else, he did not tell me of it.

Q. You were there with the engineer? A. With the patentee, Mr. St. John.

Q. Is their process of purification of gas patented? A. Yes, sir; it is in the composition. It is not in the method of purifying; some compounds they have got there.

Q. Have you ever witnessed any experiments for the purification of gas by that method except this one of the New York Company? A. No, sir; I have not. But I have read a good deal of all kinds of processes, in purifying gas. A good many patents have been taken out for oxides—oxide of iron, oxide of zinc, oxide of manganese.

Q. Do you know what agent is used in the United States, in the large cities of the United States, for the purification of gas? A. Generally dry-lime process; Philadelphia uses it altogether, nothing else.

Q. Do you know by whom the Philadelphia Gas Works are owned? A. By the city of Philadelphia.

Q. The Municipal Corporation of Philadelphia manufactures its own gas for the citizens? A. Yes, sir.

Q. And in the process of the purification of the gas it uses dry lime? A. Dry lime—yes, sir.

Q. Do you know how it is in the city of Boston? A. No, sir, not particularly; I have not heard any thing to the contrary of dry lime.

Q. Do you know of any cities or any gas works where iron or the oxides of iron, or iron filings, or that process is resorted to for purification, except the New York Gas Works? A. None that I know of or ever heard of.

Q. Which do you consider the best method of purification of gas, as far as your knowledge and experience are concerned? A. Dry-lime process.

Q. Do you know of any evils attendant upon it, or any consequences injurious to health attendant upon that process of purification of gas which would not be attendant upon any other process? A. I do not know that this is unhealthy; my family reside out of the city of New York, and I sleep off and on with a one-foot brick wall between me and the purifying-room, and I never was sick or experienced a headache, not the slightest indisposition; in short, if there were an epidemic, I would remove my family to the works. In '66, when the cholera was here, I slept that season in the works, and never experienced the slightest indisposition; if there were an epidemic, I would get my family as near the works as I could—either the yellow fever or cholera. There was but one person in Portsmouth, Va., that was taken with cholera, and he was taken from the works, and was brought back, and recovered. I have it from our engineer, who was in the neighborhood.

Q. Do you know of any thing unhealthy about the Metropolitan Gas Works? A. I do not; all our men are perfectly healthy; I do not know of a case of sickness; no later than Friday or Saturday there were two nurses, with four children, sent there by the physicians, with the whooping-cough; they were in the purification-room inhaling the gas.

Q. Is it a usual occurrence for children to be sent there? A. Yes, sir; I have known a great many.

Q. To inhale the gas as a medical agent? A. Yes, sir; I have seen gentlemen bring their children there in carriages; so it is not the lower class that comes there, but the higher class.

Q. What do you know about the health of the neighborhood of your gas works? A. It is very healthy, sir; uncommonly, sir, round our immediate neighborhood.

Q. Do you know any thing about any epidemics prevailing there, among children or adults? A. No, sir; there is a place opposite, where there are a great many families; I do not know how many; I think there is but one death in a year; it is very seldom you see a funeral.

Q. Are there many children about your streets? A. Yes, sir.

Q. It is a prolific neighborhood? A. Yes, sir, quite so.

Q. You stated you observed the process of purification at the New York Gas Works? A. Yes, sir.

Q. Will you state what you observed in regard to it, and what, if any, advantages or disadvantages there were attendant upon it, according to your observation and experience? A. I could not see any.

Q. What? A. Any disadvantages; but I think there must be a good deal in the gas, because I do not think it takes out all the *carbonic acid gas and sulphuretted hydrogen*; I do not think the iron takes all the carbonic acid gas; we want lime to detain carbonic acid gas; they were not using a particle of lime, and in many places where they do use the oxide of iron they must use lime; you cannot get along without lime, that is, if you want pure gas.

Q. You cannot get along without lime in the purification of gas and have a pure gas? A. I do not believe you can have a pure gas.

Q. The gas, you think, manufactured by the New York Gas Company is not as pure as the gas manufactured in your works? A. I do not think it is as pure, and I do not think its illuminating power is as strong; that is eye observation, from looking at it, sir.

Q. What effect has it upon the health where gas of that character is burned, where those injurious elements of which you speak are not taken from it? A. I should think injurious to health; if it was not injurious to health there would be no necessity for us to take it out, for it costs us something to do it.

Q. You take it out as a matter of healthfulness, this portion of the gas? A. Yes, sir.

Q. And the lime process really does extract them, and if they were not taken out they would be evolved in the process of cumbustion? A. Yes, sir; if we did not take it out there, the consumer would get it.

Q. Did you explain what became of the lime after the boxes were emptied? A. It was taken out, thrown into barrels and taken into the yard, and from there we ship it in canal-boats, and it is conveyed to different parts of the country as a fertilizer.

Q. And it is a good fertilizer? A. Yes, sir; we use it ourselves for filling—mixing it with "breeze" or coke-dust. Permit me to read a little paragraph. It is by Lewis Thompson, one of the best gas authorities in England. (Witness read from "The Chemistry of Gas-Lighting," London, as follows): at page 31, he says:

"Every one knows that the purifying agent first employed by Windsor was lime; and recent experiments, conducted with the most scrupulous care and by the most experienced manipulators, have shown, beyond all doubt or question, that nothing whatever is so well adapted for the complete purification of gas from its most pernicious impurities; and nothing tends so much to preserve its illuminating power, as the very article used and selected before all others by Windsor—that is to say, common lime. It would hence appear that our progress in the art of purifying gas has been *nil;* for, although almost every chemical agent of a moderately cheap kind has found itself enlisted into the service by one patentee or another, yet, in the present day, those best acquainted with the purification of gas in a particular way, tell us unanimously that lime alone is the only substance which will effectually remove the chief impurities of coal-gas, without so serious a destruction of illuminating power as to require the introduction of a new element in the calculation of the cost. That is to say, the employment of a portion of cannel coal by way of compensating for the loss which every other purifying agent but lime causes in the illuminating power of gas.

"That common lime used in a dry-lime purifier is the most effectual, economical, and least hurtful agent to which impure gas can be subjected, no practical man can venture to deny; and next to this may be classed lime used in a wet purifier, though this is much less effective, and very apt to leave carbonic acid in the gas. Of course this purification goes no further than to the acidulous compounds contained in the gas, such as carbonic acid and sulphuretted hydrogen. But something may be learned, nevertheless, from this peculiar fitness of lime, even in respect to the removal of the alkaline compounds. It would appear that neither carbonate of lime nor the hydrosulphate of lime possesses any affinity for those naphthas, or hydrocarbons, upon which the luminosity of gas depends. Hence the lime, when fully saturated, or, as the phrase is, when 'foul,' contains nothing of the light-giving principles of gas, for these have passed on untouched. A very different result, however, takes place with the oxides, carbonates, and sulphates of the metals proper."

Q. What do you say about him as an authority? A. He is a gas authority.

Q. How eminent an authority? A. One of the most eminent men. Dr. Letheby, I think, is ahead of him.

Q. What other author have you? A. Rev. Mr. Bowditch's Analysis—page 21—he speaks of all the processes from the beginning.

Q. Which process does he favor? A. He seems to favor his own.

Q. What is that? A. Hot lime and clay purification. I do not know of anybody using that at all.

Q. What does he say about the lime process—dry lime? A. Page 21, speaking of the oxide of iron, he says: "Although this process of purification is a great point to large gas companies, it has its drawback to consumers. Because when it comes into use much carbonic acid is left in the gas; and secondly, because, when the foul oxide is spread out to revivify, it casts off a quantity of very offensive compounds, which seriously annoy those who reside in the neighborhood of the works; where the foul oxide is exposed to revivify in the free air, the evolution of sickening vapors emitted by foul oxide may be carried through chimneys, and through fires, into the atmosphere so as to be rendered harmless."

I have the report of the annual meeting of the British Association of Gas Managers; they have a number of processes introduced; there is one I should like to say something about; it is the fifth annual general meeting of the General Association of Gas Managers, held in London, June 2d, 3d, and 4th, 1868; I read from the *Journal of Gas-Lighting*, page 474, from the President's Inaugural Address: "In the process of purification, but little advance has been made. Experience, however, serves to confirm Dr. Letheby, that the sulphur compounds in gas may be considerably reduced by dry purifiers of large surface, through which the gas passes slowly. This has been shown to be the case at the Great Central Gas Works, where the quarterly average of sulphur has by that means been reduced from 30 grains to less than 20 grains per hundred cubic feet." In speaking of the different tests: "Mr. Ellison, the chief of the Experimental Works of the Paris Gas Company, observes that any portion of sulphur in gas that can be injurious to health or to property, is that portion which is eliminated in the form of sulphurous acid during ordinary combinations, and that in a laboratory test, by means not commonly adopted, can extract a larger quantity of gas, is, or ought to be, useless as a test of the purity of the gas to the public." There are a great many others, if you wish to have them; I have these papers for a number of years.

Q. The dry-lime process has the effect to remove the sulphur from the gas? A. Yes, sir; sulphuretted hydrogen and carbonic acid.

Q. And is lime the best known agent that you know of to remove it? A. Yes, sir.

Q. If not removed it remains with the gas, and is evolved with its combustion? A. Yes, sir; it goes out somewhere.

Q. And makes the gas impure and injurious to health? A. Yes, sir; in 1866 the Great Central Gas Company begged to be permitted to use wet-lime purifiers; that is, in the second rank of purifiers; Mr. Thompson states, the first is dry lime, and the second is the wet-lime process; and the third the oxide of metals—of zinc, iron, or other metals.

At the thirty-first half-yearly ordinary meeting of the shareholders of the Great Central Gas Consumers' Company, held in London, October 26, 1866, the chairman said (witness read as follows): "The sulphur question is one of our great difficulties. We have grappled with it in the most effectual manner we can. We have done every thing in our power to reduce the quantity in the gas; we have gone to a large expense in picking out the pyrites from the coal, and we have employed a most eminent chemist, Professor Redwood, in addition to our ordinary staff, to assist us in our endeavors to get rid of the cause of complaint. We also invited Dr. Letheby, though without success, to visit our works, and favor us with any suggestions in his power upon the subject. It is one of those obscure things which we cannot fathom. Sometimes we are below 20 grains; occasionally we are above that standard. Of course, in purchasing coal our great object is to obtain that which contains the least sulphur, but it will occasionally happen that coal, in the same pit as the vein is worked out, is found to have a larger quantity of sulphur in it at one time than at another. We should have no difficulty whatever if we could use the wet-lime process of purification. Some companies are so situated that they can do so, but if we were to attempt to do it at Bow Common, as we used to do, we should fall again into trouble with the local authorities. We have been brought up before the police magistrate for nuisance." "The use of wet lime is, therefore, prohibited to us. We are about to try some modification of the lime process, using lime in some form, and to a certain degree, to enable us to come within the standard prescribed by Parliament, which I hope may be successful."—(*The Journal of Gas-Lighting, etc., Oct.* 30, 1866, p. 790.)

Cross-examination by Mr. Allen: Q. To come back to the gas works of the Metropolitan Gas-Light Company; how long does this refuse lime remain on the premises, ordinarily, after it comes from the purifiers? A. A month or two—week; probably we take some in less than a week.

Q. Is it deposited in the yard in heaps? A. Yes, sir; there is a heap of it in the yard now.

Q. What is the condition of this refuse lime, as to its temperature, when it comes out of the purifiers? A. It is warm.

Q. I mean at the time it is in the purifiers—is it hot or cold? A. Cold in the purifiers.

Q. On being exposed to the air, does it become hot? A. Yes, sir; it gets hot then; it is the uniting of the air that makes it warm.

Q. Are there any odors escaping from this heap after it is exposed to the air? A. The greatest odors are in the removing from the purifier and taking it out.

Q. Answer my question, please; are there, or are there not, odors that escape into the air from this refuse lime after it is removed from the purifier? A. Yes, sir; a little.

Q. Do you know of what that odor consists—of what gases? A. Odor of sulphuretted hydrogen and ammoniacal odor.

Q. It is then the odors of the gases that are absorbed in the purification? A. Yes, sir;

Q. Do they undergo any chemical change by uniting with the oxygen of the air? A. I presume they do.

Q. Do you know what? A. No, sir; I cannot say that I do. It throws off sulphuretted hydrogen and carbonic-acid gas into the air; and the lime after a while has no smell. The pile there don't smell at all.

Q. You stated in your direct examination that the carbonic-acid gas was taken out from the gas in these purifiers for the purpose of health? A. Yes, sir.

Q. Does carbonic-acid gas in the gas diminish its illuminating power? A. It does.

Q. But you extract it because it is detrimental to health? A. It would be impure gas.

Q. To what extent would the amount of carbonic-acid gas lessen the illuminating power? A. I presume it would lose a candle-power or so. Some make it a great deal more than that: and at the same time it would be impure gas.

Q. What is the amount of carbonic-acid gas, in a thousand feet of gas, before it is purified? A. I never measured: we have no laboratory to measure it.

Q. Is there any perceptible difference in the amount of this odor which comes from the amount of refuse lime in the different degrees of temperature or humidity of the air? A. It is about the same to us at the works.

Q. The amount of odor is the same in wet weather and in dry? A. To us at the works; I cannot answer any thing beyond the works.

Q. Have you ever visited the Philadelphia Gas-Works? A. Yes, sir; many times.

Q. Did you perceive this same odor from this mass of lime in those works? A. Precisely the same—yes, sir.

Q. What knowledge have you of the health of the neighborhood in the vicinity of the Metropolitan Gas-Works? A. It is said to be good.

Q. Have you any personal knowledge? A. I am there every day.

Q. Have you any personal knowledge? A. No, sir.

Q. You infer that the gas-works are healthy, from the fact that physicians have sent children there? A. I only judge from myself.

Q. You mentioned the fact? A. Yes, sir; physicians sent children there; I was myself eighteen months inside the works; I have slept inside the works, and never sick the slightest.

Q. Have you never heard of physicians giving strychnine to sick people? A. No, sir.

Q. Or calomel? Yes, sir; I have taken it myself.

Q. Would you recommend that the whole community should be given a dose of calomel or strychnine? A. Might, if it would do them good.

Q. You are not an expert in medicine? A. No, sir.

Q. You have no knowledge of the effect of this gas upon the public health? A. No, sir.

Q. Will you state what, in the process of the New York Gas-Works, is patented? A. No, sir; I never examined their claim; it is in the composition; they may use some little thing that others do not; some patents contain saw-dust; they do not use saw-dust.

Q. Have you any knowledge of the illuminating power produced by the New York Gas-Company? A. No, sir; I have heard it was 13 or 14 candles; I never examined it photometrically.

Q. Will you take that book—"The Chemistry of Gas-Lighting"—and at page 32, and read the last clause at the bottom of the page, commencing, "superior in activity"? (Witness read as follows:) A. "Superior in activity to the sulphate of lime, the muriate of that base next claims attention, and the mode of using this substance patented by Mr. Laming, seems to possess the greatest amount of advantages; but whatever the plan, the theory and practice of the application of these lime-salts are equally satisfactory; the ammonia combined with carbonic acid is arrested by the lime-salts employed, and a double decomposition, attended with the production of two new substances, neither of which have any affinity for the illuminating matters of the gas."

Q. Turn to page 36—"Chemistry of Gas-Lighting"—and read the first paragraph of the page, beginning, "And there is:" (Witness read as follows:) A. "And there is this very great advantage in favor of the aforesaid arrangement of muriate of lime, oxide of iron, and hydrate of lime, that it entirely obviates all smell and nuisance from the Gas-Works."

Q. Now, from the next paragraph, commencing at "Foul lime." (Witness read as follows:) A. "Foul lime, as it is removed from the purifier, consists of an admixture of several salts, some of which, as the ferrocyanate, sulphocyanate, and hydrocyanate of lime, are in such minute quantities as to require no notice here; but there are others, such as the carbonate and the hydrosulphate of lime, and the hydrosulphate of ammonia, which are in considerable quantity and constitute an important part of the total bulk. There is also a quantity of hydrate of lime in an uncombined state, and which may be said to be wasted. The analysis of these principal compounds shows that the salts exist in about the proportion which our estimate of the impurities in coal-gas would indicate—that is to say, more than half the mass consists of carbonate of lime, nearly one-fourth of hydrosulphate of lime, about one-fifth is hydrate of lime unacted on, and the residue contains the cyanogen, salts, and the silicious, and other impurities of the limestone, with a variable proportion of hydrosulphate of ammonia, retained in the mass mechanically. With such a mixture, it is not surprising that an offensive odor is emitted on exposure to atmospheric air, for, in the first place, the hydrosulphate of ammonia must pass into the air by a simple process of diffusion, while the hydrosulphate of lime, being acted upon by the carbonic acid of the atmosphere, will give rise to the formation of carbonate of lime, and a copious evolution of sulphuretted hydrogen gas. And it is in this latter particular that the use of oxide of iron has its greatest recommendation; for, as we have before stated, the affinity of oxide of iron for sulphuretted hydrogen is greater than for carbonic acid, whereas with lime the contrary is true. Hence the sulphuret of iron, not being decomposed by the carbonic acid of the air, emits no odor, while the sulphuret of lime is readily decomposed, and thus produces an abominable nuisance."

Q. Now please read from page 37, the fourth paragraph, commencing, "But where." (Witness read as follows:) A. "But where the necessity for avoiding nuisance is considerable, the spent lime should contain as little ammonia as possible, for the sulphuret of calcium alone decomposes very slowly by contact with atmospheric air, and has rather a tendency to absorb oxygen and generate hyposulphite of lime than to evolve sulphuretted hydrogen by combining with carbonic acid. When ammonia, however, is present, this rapidly absorbs carbonic acid; and the carbonate of ammonia, thus produced, instantly reacts upon the moist sulphuret of calcium, whence result carbonate of lime and hydrosulphate of ammonia—the latter of which, by evolving its characteristic odor, gives rise to the well-known offensive stench of gas-lime refuse."

Q. Read from page 41, the last clause of the middle paragraph. (Witness read as follows:) A. "Hence the oxides of manganese, iron, zinc, lead, copper, and antimony, have been laid under the 'taboo' of the patent law by various inventors, though at present the oxides of iron, lead, and antimony, are the only ones in practical use in this country."

Q. Page 51, the last paragraph. (Witness read as follows:) A. "In the April number of the *Journal of Gas-Lighting*, for 1850, a communication will be found from a correspondent of the *Mining Journal*, which illustrates the above position. Having prepared a mixture of lime and sulphate of iron, so as to produce hydrated sesquioxide of iron, this was placed in a dry-lime purifier, and the first trial was found to have purified only 1,500 cubic feet of gas; after exposure to the air it purified 2,400 cubic feet; on a second exposure to the air, it purified 3,050 cubic feet, and ultimately, upon another exposure, it reached as high as 4,200 cubic feet, or very nearly three times the original quantity; and this result accords exactly with the daily experience of gas engineers upon the subject."

Q. In the work of Mr. Lewis Thompson, in the paragraph you read on the 31st page, as I understand the drift of this work, it is to determine which is the most economical method of manufacturing gas? A. The least hurtful; on the same page it says that dry lime is the most effectual, economical, and least hurtful agent to which impure gas can be subjected.

Q. I want to get at what he means by "hurtful;" hurtful to the public or hurtful to the gas? A. Hurtful to the gas, I presume.

Q. Is this work ("Chemistry of Gas-Lighting") a sanitary work, or a practical work for the gas-manufacturers? A. It was written for the science of gas—for the gas engineer.

Q. Has no bearing whatever upon the results of gas-making in a sanitary point of view? A. I think not; it is to render impure gas pure gas; the object is to deliver as pure a gas to the consumer as possible; if it is an impure gas, it is unhealthy, I presume.

Q. I understood you never had had any experience yourself in the oxide-of-iron process?

A. No further than the little experiments I spoke of; but not in a general way; for it is not used in this country.

Re-direct examination by Mr. Van Voorst: Q. How soon do the odors from the lime-heap escape after being removed from the boxes? A. Almost as soon as the lids are removed.

Q. How soon does it terminate? A. Within three or four hours.

Q. Does that heap of lime emit any odors? A. No sir; not that I know of, sir.

Q. The heap of lime itself, after it is removed for two or three hours, emits no odors? A. No, sir; the spent lime emits no odors.

Q. Your attention has been called as to whether you have any experience as to the health of the community; I ask you, what portion of your time have you spent in these particular gas-works for six or eight years past? A. I am there probably half my time.

Q. In the works? A. I am there four times a day, sir; probably an hour each time.

Q. Have you any knowledge of any disease prevailing in that neighborhood among children or adults, more than any other part of the city? A. No, sir; I have not heard of any.

Q. Or whether that neighborhood is a healthy or unhealthy neighborhood? A. Never heard of its being unhealthy.

Q. Ever heard of any complaints from people in the neighborhood of it? A. No, sir; I have heard them complain of smells, but smells of fat-houses.

Q. Are there fat-houses round there? A. Yes, sir; there is a steamship that boils animals I have seen piled up on the pier; I think Thirty-eighth Street; it is terrible; sometimes made me sick.

Q. Where is that? A. That is on the North River, just below me.

Q. Describe what kind of an establishment that is. A. I have never seen it, only from our works; I have seen animals go there.

Q. Dead animals that are carried there? A. Yes, sir.

Q. Boiled up? A. Yes, sir; or cut up in some way.

Q. Did you detect the odor from those works? A. Yes, sir.

Q. I want to know what it is. A. There is dead animals boiled there.

Q. Animals which have died a natural way are sent there and boiled? A. Yes, sir; I have smelt it for eight years.

By Mr. Allen: Q. Those are odors of decomposed animal matter? A. Yes, sir.

By Mr. Van Vorst: Q. Very disagreeable and very offensive? A. Yes, sir.

Q. Do you know of any other causes of the production of disagreeable and offensive odors in that neighborhood? A. No, sir; there is a sewer.

Q. How long has that establishment for boiling of those dead animals been there? A. It is eight years since I went there, and I have smelt it there every year.

Q. Is it existing there? A. Yes, sir.

By Mr. Allen: Q. Has it ever made you sick? A. Yes, sir.

By Mr. Van Vorst: Q. Do you know of any useful purpose it is accomplishing? A. No, sir.

By Mr. Hasbrouck: Q. About how much lime is used? A. The charge to a purifier would be about 250 bushels.

Q. Is it not practicable to immediately convey this lime, when it is taken out of the purifier, away to some place where it will be inoffensive? A. I think in a few hours after there is no smell.

By Mr. Van Vorst: Q. How often do you open the boxes? A. Every two or three days; it is according to the gas passed through; in the winter time, when passing a large amount of gas, every day.

Q. Do you know any thing about the arrangement made by the company for the removal of the lime? A. No, sir; the president has that arrangement.

Q. It is not allowed to remain there any longer than necessary? A. No, sir.

TESTIMONY OF PROF. C. F. CHANDLER, CHEMIST, TO THE BOARD OF HEALTH.

By Mr. Allen: Q. What is your profession? A. Chemist.

Q. Are you connected with any public institution in this city? A. Yes, sir; I hold the chair of Analytical and Applied Chemistry in the School of Mines of Columbia College?

Q. And also Chemist of the Metropolitan Board of Health? A. Yes, sir.

Q. Have you paid special attention to the chemistry of illuminating gas? A. Yes, sir.

Q. From what is illuminating gas prepared? A. Bituminous coal.

Q. What is the composition of bituminous coal? A. Carbon and hydrogen, with some sulphur and nitrogen, and earthly and silicious impurities which constitute the ash.

Q. How is the gas prepared from the coal? A. By exposing it to a high temperature in retorts of iron or clay.

Q. What are the products of this? A. Coke, tar, ammoniacal liquor, and gas.

Q. What becomes of these products? A. The coke remains in the retort; the tar and ammoniacal liquor accumulate in the hydraulic main, and in the condenser and scrubber; the gas passes on to the purifiers.

Q. What is the composition of the gas as it leaves the hydraulic main you speak of? A. It consists chiefly of marsh gas, carbonic oxide, and hydrogen, which are the non-illuminating combustible constituents; of olefiant gas, and several other hydro-carbon gases and vapors which are the illuminating constituents—sulphuretted hydrogen, carbonic acid, ammonia, cyanogen, sulpho-cyanogen, nitrogen (I believe those are the most important ones), bisulphide of carbon, aqueous vapors; this last group of eight constituents constitute the useless or injurious impurities; I did not mention the hydro-carbons individually; there are a dozen or twenty which I group.

Q. Have you ever visited the works of the Metropolitan Gas Company? A. Yes.

Q. What process do they use there for purifying the gas? A. The dry-lime process.

Q. What is the composition of the lime after it has acted upon the gas? A. It consists essentially of sulphide of calcium, carbonate of lime, hydrate of lime, and contains small quantities of ammonia, cyanide of calcium, sulpho-cyanide of calcium.

Q. Is that all? A. Except a little tarry matter; maybe minute traces of other things, but those are the essential constituents.

Q. What occurs when this spent or useless lime is exposed to the air? A. The ammonia absorbs carbonic acid, forming carbonate of ammonia; the carbonate of ammonia decomposes the sulphide of calcium, forming the sulphide of ammonium, which is evolved; carbonic acid decomposes sulphide of çalcium, liberating sulphuretted hydrogen; oxygen is absorbed with the evolution of heat, and the formation of hyposulphite, sulphite, and sulphate of lime. These are the more important reactions.

Q. What is the nature of this gas as to its offensiveness, when evolved in the air? A. The sulphuretted hydrogen and sulphide of ammonium are the predominant constituents of the disagreeable odors evolved by the lime refuse.

Q. The fact is they produce a disagreeable odor? A. They have a disagreeable odor.

Q. Is this disagreeable odor equally perceptible in all kinds of weather? A. No; in dry, clear weather, the odors rise rapidly in the air, but in damp, heavy weather, particularly with the wind favorable, the odor will diffuse itself throughout the neighborhood.

Q. Would this lime be equally offensive, if more lime were used for the same quantity of gas? A. It would make a little difference, perhaps, but the odor is not due to over-saturation; in fact, the refuse contains fifteen or twenty per cent. of unchanged hydrate of lime; consequently it is never over-saturated.

Q. Is it possible to prevent the escape of foul odors from the dry-lime process? A. I think not.

Q. We come to another point: Is it necessary to employ the dry-lime process for the purification of gas? A. I think not; I know it is not.

Q. What is the wet-lime process? A. That is a process in which the lime is mixed with a large quantity of water, to the consistency of cream, and the gas obliged to bubble through it; the chemical reactions are the same as in the dry-lime process.

Q. Is that in general use? A. No; I have seen it in use in some places, but I believe it is generally abandoned; it is sometimes used with the iron process, for the more complete removal of carbonic acid, after the sulphur has been removed by oxide of iron.

Q. What is Laming's process? A. It consists in using a mixture of the hydrated sesquioxide of iron, sulphate of lime, hydrate of lime, and sawdust, or some other porous material;

the mixture consists of dry-slacked lime and sawdust in equal quantities, to which is added, for every pound of lime, one pound of sulphate of iron (copperas), dissolved in water. The mixture is exposed to the air for twenty-four hours, to oxidize the protoxide of iron to the sesquioxide. It then consists of hydrated sesquioxide of iron, sulphate of iron, hydrate of lime, sawdust. In the place of copperas, double the weight of sesquichloride of iron is sometimes used, when the mixture consists of hydrated sesquioxide of iron, chloride of calcium, hydrate of lime, sawdust.

Q. What are the disadvantages of Laming's process? A. It is said to be somewhat more expensive in some cities than the dry-lime process, while in other places it is said to be much cheaper.

Q. Has it any advantages? A. It has been claimed by some that the gas suffers slightly in illuminating power, though even if this be true, it could easily be remedied by the use of a larger proportion of cannel coal, or the use of small quantities of Albert or Boghead coal; it is stated, however, by others, that no such loss in illuminating power occurs; Unruh, in Magdeburg, where the process is employed, found that the illuminating power was not at all diminished, while the sulphuretted hydrogen was entirely, and the carbonic acid almost entirely removed, the process being much cheaper than dry lime; it has also been stated that it fails to remove the carbonic acid completely, but, should this difficulty occur, it can be easily remedied by the use of a little lime after the iron mixture; those are the answers to the disadvantages.

Q. Has it any advantages? A. The gas passes more readily through the mass; the mixture may be used over and over again, and when it finally becomes useless for purifying gas, may be sold for the extraction of the sulphur it contains; but the most important advantage consists in the entire suppression of the disagreeable smell which is evolved from the dry-lime refuse.

Q. Will you describe the iron-ore process? A. In the iron-ore process, brown hematite, or bog-iron ore, in coarse powder, is employed to absorb the sulphuretted hydrogen; this substance is an impure hydrated sesquioxide of iron, and has the same action on the sulphuretted hydrogen of the gas as has already been mentioned in describing Laming's process; I am informed that at the new gas-works in Berlin a bog-ore from Silesia is employed; it is dried, pulverized, sifted, and placed in the purifier either alone or mixed with sawdust; it is cheaper than Laming's mixture; it is regenerated slower at first, but more rapidly afterward, and its action on the gas increases with use; at Hanover, the iron-ore of Lunenberg mixed with spent tan-bark is employed.

Q. Is this process in use in this country? A. With slight modifications it is employed at the New York Gas Company's works, on East Twenty-first Street.

Q. What are the modifications employed at the New York Gas-Works? A. Iron-ore from Staten Island is mixed with sufficient quantity of iron turnings, filings, or borings, to increase the amount of iron to eighty per cent.; the mixture is moistened with ammonia-water and exposed to the air, when the metallic iron is rapidly oxidized; when dry, it is mixed with about five per cent. of charcoal powder; it is then slightly moistened with water and placed in the purifiers in a single layer two feet deep; when the mixture ceases to act upon the gas, it is withdrawn and exposed to the air, when it is rapidly regenerated, and may be used over and over again; the mixture now in use at the works has been in use since April 21st.

Q. Is that process effective as a purifier? A. I cannot say of my own knowledge, but have heard no complaints with regard to the quality of the gas.

Q. Does the mixture evolve any disagreeable odor after it is used? A. I have noticed none; I was there while the material was being taken out of the purifiers and shovelled over; I detected no odor of sulphide of ammonium or sulphuretted hydrogen.

Q. Is it more expensive than the dry-lime process? A. I should think not. The ore costs five dollars a ton, and is used again and again, while lime is used but once. I was informed that the New York Company spent from $18,000 to $19,000 a year for lime by the old process.

Q. Is this process used by the New York Company patented? A. The combination of ore, iron-turnings, and charcoal, is covered by a patent; but the use of iron-ore, or of the oxide of iron, is not covered by a patent in this country, to the best of my knowledge. I would not say decidedly, for I have not consulted the patent records to ascertain, but I think not.

Q. State generally, from your information, what processes are in use in Europe? A. I have learned from numerous authorities that the iron process, either as Laming's process or as iron-ore, is used in most of the large cities of Europe.

Q. To your knowledge, have any of the commissioners sent to the Paris Exposition reported? A. Prof. J. Lawrence Smith, Professor of Chemistry in the Medical College at Louisville, and president of the Louisville Gas Company, made a report which, I am informed, was printed in the *American Gas-Light Journal*, though I have not seen it. I have in my possession a letter from him.

Q. As a matter of information, state what he says. A. He states that the oxide-of-iron process is generally used in all the cities of Europe. I do not like to say whether be says Europe or Continent without glancing at it.

Q. Does this process of purifying gas by iron-ore require any complicated apparatus? A. The usual dry-lime apparatus; of course some minor change, but no expensive change, in the apparatus is necessary.

Q. Is there any essential difference in the coal employed in this country and that employed in Europe, which would make a process which is successful there, unsuccessful here? A. I think not. I have analyzed numerous specimens of American coal, and do not remember that there was any thing peculiar in their composition; that is, the coal used for gas-making. We have a great deal of anthracite, but that is not involved in the question of gas-making.

Q. Generally, is it possible to obviate the present nuisance from gas-works? A. I think it is.

Q. How? A. By introducing the iron process of purifying.

Q. How long would it take, in any particular gas-works, to make the changes necessary —take the Metropolitan Gas Works, for instance—how long would it take to make these necessary changes? A. It is difficult to say how long; they would have to procure their oxides of iron. I should think two or three weeks.

Q. Would it interfere, meantime, with their manufacture? A. Not at all. Particularly as they have four idle purifiers. They could experiment on those without interfering at all with the four purifiers now employed for the dry-lime process.

Q. Are sulphuretted hydrogen gas and the sulphide of ammonium injurious to health? A. They are both poisonous gases.

Q. The question was, are they injurious to health? A. They are.

Q. Did you ever know any one to be injured by them? A. One of my assistants was rendered insensible by breathing sulphuretted hydrogen in the laboratory at Union College.

Q. Are all persons equally susceptible to them? A. No, they are not; my instructor in Berlin could not breathe sulphuretted hydrogen without getting a headache at once, while I have never suffered from it. Numerous instances have occurred in which persons have been killed by sulphuretted hydrogen.

Q. Why is sulphur removed from the gas at all? A. Because it produces *sulphurous acid*, the burning of which vitiates the atmosphere, and it also acts upon metals, brass, and copper, and would injure the brass fixtures.

Q. Why is the ammonia removed? A. If it is left in the gas, it produces *nitrous acid*, which would vitiate the atmosphere.

Q. Why is the carbonic acid removed? A. Because it diminishes the illuminating power of the gas.

Q. Is there any sanitary objection to the carbonic-acid gas being allowed to go through the main? A. I should say not, for the reason that the combustion of the perfectly purified gas would produce many times as much carbonic acid as would commonly be contained in it. Consequently the quantity in the gas is a very trifling matter.

Hearing adjourned to Thursday, August 13, 1868, at 11 o'clock A. M.

Prof. Chandler was cross-examined on February 6, 1869. *See page* 483.

MEMORIAL OF THE METROPOLITAN GAS-LIGHT COMPANY.

To the Honorable the Metropolitan Board of Health:

The Metropolitan Gas-Light Company, of the City of New York, would respectfully represent that this company is the youngest of all the gas companies which supply the citizens of New York with gas; that its operations were commenced in the year 1863.

That its object from the beginning was to supply the consumers with pure gas, and to conduct its manufactory in the best manner, and according to the most approved methods science and experience could suggest.

That no complaint was ever made to this company that its method of purification of gas was offensive to the public, and that the first knowledge that the directors of this company had that your Board regarded its process of purification as injurious, was the order of the 14th day of July, 1868.

The undersigned respectfully submits that the method adopted by this company for the purification of the gas delivered by it to the consumers is such as is in use in all the large cities of the United States, and is such as this company has had good reason to believe was the best which science and experience could suggest to effect the object to be secured—the delivery of the best gas to the consumer, and manufactured in a way to be the least offensive.

The dry-lime process of purification used by this company is in general use by the gas-manufacturers in the United States, as best adapted to free the gas from all impurities and offensive elements and substances. This company is aware that other methods of purification have been resorted to by some English companies, and on the Continent of Europe, by the use of oxide of iron for this purpose. But, as at present advised, such method has not fully succeeded to the satisfaction of either the manufacturer, consumer, or the public. It is urged by the objectors that the gas delivered by such process of purification is not freed from the offensive elements which the dry-lime process removes, is impure, and injurious to the health of the consumer; and it is represented to the undersigned that companies in Europe which had adopted it, have abandoned it and gone back to the lime process.

This company has not yet had an opportunity to subject to a scientific and practical test the advantages of this method or others which may be suggested.

Unaware that any complaints were pending before your Board as to the operations of *this* company, and having no reason to believe that any just cause of complaint existed, it has heretofore used, as above mentioned, the lime process of purification.

Since the service on the company of the order of the Board of Health, declaring this company's method of purification to be a nuisance, some testimony has been taken before D. B. Hasbrouck, Esq., at the rooms of the Board of Health, in regard to the advantages of the lead process of purification, and also of the iron process, which examination is still pending, unconcluded.

The undersigned, most respectfully protesting against the adjudication of this Honorable Board, that their process of manufacture or purification of gas is a nuisance, still avow their entire willingness to try any method which science may suggest and experiment demonstrate to be a better one than that now in use. This company is not wedded to, and has no special interest for, the lime process of purification. If there is a better process it would gladly adopt it, so that it may manufacture gas in the least offensive manner, and deliver it to the consumer in the purest form.

This company submits that the mode of purification with the oxide of iron, or with iron in connection with other substances, is as yet an experiment only; and that such trial of its utility has not been had as to justify this company to abandon its present process, and incur the hazard and expense of adopting it.

It is true, as the undersigned are informed, that one of the companies in New York has lately experimented on the iron process of purification, but the experiments have been so recent that they cannot as yet be called a success, and would not justify the undersigned in adopting it without a trial by themselves.

This company would respectfully suggest to your Honorable Board, that all proceedings under the order of the Board, including the further taking of testimony, be suspended unti the Metropolitan Gas-Light Company shall have had time to subject the method of purification proposed, and other methods, to a practical test in its own works, and shall have had an opportunity to give the same a chemical examination by proper experts.

For this purpose the undersigned request a suspension of proceedings under the order, and the further taking of testimony, until the first day of March next.

This company is at present engaged in considerable improvements in extending its works, and cannot in justice to the subject, its own interest, and that of the consumers of its gas, before the time named, sufficiently and properly at its own works examine into and practically test the new method proposed. At the expiration of that time, this company will be prepared by experience to report to your Honorable body the result of such scientific examination and trial.

Should this company suspend operations in the manufacture and delivery of gas for a single day, the community would be subject to great inconvenience, this company to large fines, and its chartered rights be put in jeopardy.

It is submitted that time and opportunity should be granted to this company fairly to test by experiment the method of purification proposed; and should such trial and experiment prove that the method suggested is the best and freest from objections in regard to all the parties and interests affected, including the sanitary and healthful consideration of the matter, this company would gladly adopt it, or any other measure which judicious experiment should suggest.

The directors and corporators of this company are residents of the city of New York, and in common with all other citizens are interested in the health of its inhabitants.

This company would do nothing to endanger the health of the city, and will do all in its power so to conduct its business in the mean time as to invoke no unfavorable action on the part of this Board, nor any complaint from any citizen.

All of which is respectfully submitted on behalf of the Metropolitan Gas-Light Company:

H. C. Van Vorst,
Of Counsel.

O. ZOLLIKOFFER,
President.

New York, *August* 17, 1868.

The hearing in the case was postponed to December 1, 1868, in order to give the Gas Company an opportunity to make the necessary experiments and changes.

SECOND MEMORIAL OF THE METROPOLITAN GAS-LIGHT COMPANY.

Office of the Metropolitan Gas-Light Company, New York.

To the Honorable the Board of Health:

The undersigned, the President of the Metropolitan Gas-Light Company, had the honor heretofore to address to your Board a memorial in behalf of this company, in respect to certain proceedings pending before the Board of Health in respect to the method used by this company in the purification of gas.

This company, desirous of doing every thing proper to be done, so that the gas they manufacture may be delivered to the consumers freest from injurious elements, and so as to be least objectionable to the public in the process of its manufacture and purification, evoked the postponement of all proceedings before the Board of Health until the first day of March next.

This company, intending in the mean time to obtain the most reliable information to be had in this country and in Europe, in regard to the best method of manufacturing and purifying gas, considered chiefly in a sanitary point of view, and to avail itself of the best experience to be had on this subject, and to make proper experiments itself: this company thought the time evoked was not unreasonable, especially as it would occur in the season of the year when the least complaint could be made of unpleasant odors in the atmosphere, and when little if any inconvenience could be experienced from this source, your Board postponed all proceedings until the first day of December, instant.

In the mean time this company had sent to Europe an expert to observe the methods in use in the purification of illuminating gas in the chief capitals there, and to gain and report to this Board the result of such investigations, especially in its sanitary relations to this subject. The person so sent is a distinguished chemist; he is now prosecuting his inquiries abroad, and is expected to bring back to this company within a short time valuable information in respect to this matter.

The President of this company attended at the Board of Health on the 1st of December last, to make such statement, and to ask a further postponement until the 1st day of March next of the proceedings; but the Board of Health was not in session, nor was there in attendance the officer of the Board who had the matter in charge.

This company, therefore, again ask the Board of Health to postpone all proceedings until the 1st of March next.

In the mean time this company will have received the desired information from abroad, and will have made additional tests and experiments.

In closing this communication, this company again suggest to your Honorable Body that the method of purification in use by them—the dry-lime process—is such as is in general use in the city of Philadelphia, and in all the chief cities of the United States; that it is by no means established that the process of purification by iron is free from disagreeable or noxious vapors, but, on the contrary, it is claimed by chemists and persons well informed that the gas delivered by that process of purification to consumers has a greatly diminished illuminating power; that it is not eliminated from elements injurious in their effects to the consumer, and which the lime process entirely removes.

This company would hesitate to pronounce decidedly upon this matter at this moment, and only desires to avail itself of the best experience, and the latest improvements in science and manufacture, to deliver the best and purest gas, and manufacture it in a manner the least objectionable, and will be glad to coöperate with the Board of Health in this regard, and your petitioner will ever pray.

O. ZOLLIKOFFER,
President.

Dated New York, *December* 16, 1868.

The hearing was again postponed at the earnest request of the Gas-Light Company to February 1, 1869.

On February 6, 1869, the Gas-Light Company having made no changes in their process of manufacture, the hearing was resumed.

CONTINUATION OF THE HEARING BEFORE J. C. HAWLEY, REFEREE.

New York, *February* 6, 1869—1 P. M.

Professor Chas. F. Chandler, recalled and cross-examined by ex-Judge H. C. Van Vorst, testified as follows:

Q. Have you given much attention to the chemistry of illuminating gas? A. I have been interested in the chemistry of gas to a greater or less extent for the last fourteen years.

Q. Have you had occasion to visit many gas-works? A. Quite a number.

Q. In Europe? A. Some in Europe.

Q. In this country? A. In this country.

Q. Have you visited the Philadelphia gas-works? A. I think I did visit them, but I have not a very definite recollection. I saw all the sights in Philadelphia that interest chemists. I think I have visited the gas-works there.

Q. Can you state what process is in use in the United States for the purification of gas? A. The dry-lime or the wet-lime process.

Q. Which generally? A. The dry-lime, I think.

Q. How extensively does that prevail? A. Almost entirely.

Q. Are you acquainted with any exceptions to it? A. The New York Gas Company of this city, and two or three companies in New England.

Q. Can you say where those gas companies in New England are located, that use any other process except the dry-lime process? A. I should not like to say definitely.

Q. You don't know? A. I have seen statements and letters from parties using the other process; but I have not interested myself sufficiently on that point to ascertain.

Q. Can you say then that any process for purification, except the dry-lime process, is used of your own knowledge, by any other company except the New York company, to which you have alluded? A. I have not seen it—no.

Q. Nor can you mention by name any other company in any place that uses any other process, except the lime process? A. Well, I think the Worcester and the Malden are using the iron process.

Q. Do you know that they do? A. I have been so informed. I think those companies were the ones.

Q. You think you have been informed? A. I have been informed that companies were using it, but my memory is a little uncertain as to which companies they were.

Q. In the United States? A. Yes, sir; but I am a little uncertain as to which.

Q. Except the New York company? A. Yes, sir.

Q. Do you know Professor J. Lawrence Smith, of Louisville? A. I do—yes, sir.

Q. You have spoken about him on your direct examination? A. I have.

Q. Have you received some communication from him? A. Yes, sir.

Q. He is the President of the gas company at Louisville? A. Yes, sir.

Q. Do you know what process of purification is adopted in his company? A. I suppose the dry-lime process.

Q. You suppose that this is in use in his company? A. Yes, sir.

Q. Did you then mention all the elements of crude gas?* A. I think not. It was not my intention to mention them all.

Q. What elements do you now state to be in the crude gas which you did not then state? A. There is such an indefinite number found in the gas, and I have mentioned only those most important, that I should have to refer to my evidence to say which I did mention. I do not recall any important constituent that I should like to add to this list.

Q. There are none that you desire to add to it? A. No.

Q. Did you regard carbolic acid, or phenol, as important? A. I did not.

Q. Is it a constituent of crude gas? A. There are minute traces of it in the crude gas.

Q. Have you visited the Manhattan works? A. I have.

Q. Did you not then discover the presence of phenol—indications of it? A. There was a slight odor which might be called that (phenol), and it might be a dozen other things—not with certainty.

Q. Where did you discover that? A. I may say that there was a substance there that one of my companions † pronounced to be phenol, though I did not feel certain about it. It was discovered about the spent lime which had been used to purify the air drawn from the main purifiers; also in the air which the Manhattan Company was allowing to pass into the atmosphere, in which we also discovered sulphuretted hydrogen.

Q. When you say in your testimony that the waste lime contains but small quantities of ammonia, do you include that contained in sulphide of ammonium or only free ammonia? A. I include ammonia in all forms.

Q. Is there not such an excess of ammonia in all cases that all the ammonia must be in the form of sulphide of ammonium? *Witness.*—Do you mean in the gas or refuse lime? *Counsel.*—Refuse lime. A. No; I think not.

Q. Why not? A. Because there is an excess of lime there.

Q. Is there much naphthaline in the waste lime? A. There is some naphthaline.

Q. Not much? A. No, I should say not much.

Q. Have you visited the Manhattan works since your direct examination? A. Yes, sir.

Q. Have or have not your views of the constitution of waste lime been modified by your observations during your visit to the Manhattan works—waste lime as spoken of in your testimony? Your testimony was given with regard to the character of waste lime after it had acted as an agent in the purification of gas. A. Then my views have not changed with regard to the character of waste lime in general.

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* Referring to Prof. Chandler's former testimony.

† Prof. Wurtz.

Q. Has it in any regard changed? A. It has changed somewhat in regard to the waste lime of the Manhattan Gas Company.

Q. How so? In what regard has it changed? A. I don't consider the waste lime of the Manhattan Gas Company nearly as offensive or as liable to produce a nuisance as that of companies not employing the process used there.

Q. What do you understand by the term nuisance?—you use the word. A. Something so disagreeable to the senses or the sense of smell, in this case, as to cause complaint.

Q. Can you move in any direction in the city without incurring something which is disagreeable to the sense of smell? A. Yes, sir. I walk up Fifth Avenue frequently without smelling any disagreeable smell.

Q. Is that the only exception you make? A. No.

Q. Generally? A. Nuisances are by no means rare, and they differ in degree.

Q. Generally speaking, now, with regard to moving in any direction, persons that have delicate olfactory nerves—can they go anywhere in the city without meeting something which is disagreeable to the sense of smell? A. No, I should think not.

Q. In the order of nature and the economy of the management of cities those odors are constantly being evolved? A. Yes, sir, to a greater or less extent.

Q. From a variety of causes? A. Yes, sir.

Q. Is there not, as yet, much obscurity in the minds of the chemists generally about the complete nature of the action of the lime—the complete composition of the waste and the effluvia therefrom? A. I think the main principles are pretty well settled. There is a difference of opinion about the details and the minor reactions that take place.

Q. Is there not much obscurity still? A. There is, about the minor changes that take place.

Q. Do not these require yet considerable analysis and investigation to reduce our knowledge to precision for scientific purposes? A. They do. For sanitary purposes they do not.

Q. Is it not reasonable, doctor, even for sanitary purposes, to expect such investigation would develop important improvements in the use of the dry-lime process by which its offensive features, of which you have spoken, may be removed? A. I have no wish to predict the success of the future investigations in that direction.

Q. Don't you think that there is any thing about it that would warrant any such conclusion as that? A. Only as far as the investigations are liable to result in improvement.

Q. Is there any thing in the subject-matter itself which would warrant such a conclusion as that? A. Conclusion to what effect?

Q. By which the offensive features of the dry-lime process may be removed. A. I have already alluded to the fact that a process is in use in New York, in which the offensiveness is to a great extent removed.

Q. That is the Manhattan Gas Company? A. Yes, sir.

Q. Aside from that? A. Aside from that I have no reason to have an opinion one way or another.

Q. In reply to the question as to what occurs when the spent lime is exposed—the lime that has performed the office of purifying the gas—you described three or four actions, which of these predominates? A. These reactions succeed each other so that it is difficult to answer that question directly.

Q. Which predominates? A. Ultimately the oxidation of the sulphide of calcium predominates.

Q. Does not the oxidizing action predominate, as shown by the heat evolved? A. The heat evolved would not prove any thing with regard to the comparative reactions which take place.

Q. Then you infer that the oxidating action predominates otherwise than is exhibited by the heat? A. Yes, sir.

Q. It does predominate? A. I infer that it predominates, from the fact that the sulphide of calcium is the predominating substance susceptible of change.

Q. Does the atmosphere contain enough carbonic acid to give prominence to the other two actions you suppose? A. It does.

Q. Would not the oxidating action occur with the sulphide of ammonium as well as with the sulphide of calcium, converting it into hyposulphite or sulphite of ammonia? A. I would infer from my laboratory experience that sulphide of ammonium is evolved directly into the atmosphere without undergoing material change.

Q. And you speak from no other experience except that, in that connection? A. Yes, sir.

Q. Except your laboratory experience? A. Yes, sir.

Q. Is not sulphide of ammonium a very unstable, perishable, and transient substance in the air? A. While I have no doubt that it ultimately undergoes decomposition in the air, I know, from years of experience, that it remains intact long enough, for a considerable length of time, as shown by its persistent odor.

Q. Where was that experience obtained? In the laboratory? A. In the laboratory.

Q. I am now speaking about the external air, outside of the laboratory. A. It don't make any difference on that point.

Q. Is it any more perishable in the external air than it is in the laboratory? A. No.

Q. Is it not more readily dissipated? A. Distributed, of course.

Q. You were talking about decomposition, and not distribution. It is decomposed more readily in the external air? A. It is not.

Q. But it is distributed more readily? A. Undoubtedly, if the wind is blowing, it is distributed more readily than if shut up in the room.

Q. But is not lost. A. Do you mean by decomposition?

Q. In any way? A. It is lost if it is carried off by the wind, of course.

Q. And that is the only way in which it can be destroyed? A. I have already stated that it may undergo decomposition.

Q. How may it undergo decomposition? A. I am not prepared to give the definite decomposition that might take place.

Q. Is it likely to undergo decomposition? A. I should think it might be.

Q. How soon? A. I can't say.

Q. How soon after being evolved? A. I can't say how soon.

Q. Have you no idea? A. No definite idea.

Q. Is chemistry unable to furnish any solution of the manner in which it is decomposed, or the time in which it may be decomposed in the external air? A. Probably it is able to do so. I don't claim to carry all the facts of science in my head.'

Q. I want only to know, as far as your experience goes, whether chemistry can determine that question—as far as you know? A. I can only say that I have not studied up that particular point.

Q. Is not sulphuretted hydrogen quickly destroyed by the air? A. Yes, sir, ultimately —I suppose so. Sulphuretted hydrogen would be oxidized by the air.

Q. You make substantially the same answer to that you do to sulphide of ammonium—that it becomes decomposed after a while? A. Yes, sir, I suppose so.

Q. Within what time after its evolution? A. That I can't say.

Q. Sulphide of ammonium being volatile, would it not be necessarily decomposed by contact with the large excess of caustic lime left in the spent lime? A. It may be partially decomposed, but I think it is not completely decomposed.

Q. To what extent? A. I have no data to say—to decide.

Q. Would not ammonia be thus set free and the sulphide of calcium formed? A. That reaction might occur to some extent.

Q. Is it not a necessary consequence? You say it might. A. It is not a necessary consequence, because the hydrate of lime in the spent lime is so protected that it is not capable of exerting the action which it would exert under other circumstances, as shown by the fact that it is impossible to change all the hydrate of lime in the purifiers.

Q. Is pure ammonia offensive? A. Not in moderate quantities.

Q. In quantities which are given off from such spent lime would it not be? A. No.

Q. Is the ammonia from the stables offensive? A. Pure ammonia from the stables is not offensive.

Q. Nor deleterious to health? A. No.

Q. On the other hand, is it not regarded for certain complaints as healthful? A. I should not care to answer the question in regard to that—that is to say whether it is healthful, or not. I should not like to say about that. I believe it is; I am not a physician.

Q. But you don't regard it as deleterious to health? A. I shouldn't consider it so.

Q. You have spoken with some degree of favor, in your direct testimony, of the kinds of oxide-of-iron methods, and especially of the Laming process? A. Yes, sir.

Q. Do you believe that these methods are equal in purifying the gas from sulphur to the lime process? A. Not having investigated that point myself, and finding a difference of opinion among authorities, I am not in a position to answer the question definitely.

Q. I should like to have your opinion on that subject as an expert. A. It is my opinion that, while the lime process may take out a little more sulphur than the oxide-of-iron process, that the difference in the effect of the two is not sufficient to counterbalance the other advantages of the iron process. There are several iron processes.

Q. In your opinion, then—I am going back to the question, because you have brought in other matters which I have no objection to, at all—I ask you then, in your opinion, whether they are equal—these two processes, the lime and the iron—equal in purifying the gas from sulphur? A. I think there is a slight advantage in favor of the lime process.

Q. Does the iron method extract the sulphur which is in the form of bisulphide of carbon? A. That question has never been determined by experiment, to my knowledge.

Q. You can't answer the question? A. No; not to my knowledge.

Q. Does it take out phenol? A. I should make the same answer to that question that I made to the other.

Q. Does the iron process take it out? A. It does not.

Q. Do you mean that lime takes it out of the crude gas? A. Yes, sir; it probably takes out at least a portion of it.

Q. But you can't say the iron takes out any? A. Not with certainty.

Q. You did discover in the Manhattan Works evidence that the phenol had been taken out—what you supposed to be phenol? A. No; I did not suppose it to be phenol; that is, there was an odor there that reminds one of phenol, but I do not consider that in sufficient quantity to establish its identity.

Q. What could it have been if it was not phenol? A. A hundred other things. The number of substances occurring in gas is so little known that it is not safe to decide from the slight resemblance in odor.

Q. I understand you to say that the lime process would eliminate the phenol? A. I think it would probably remove some of the phenol.

Q. How can the oxide-of-iron method take out the ammonia from the crude gas? A. I never said it could.

Q. It can't take it out, then? A. The ammonia is taken out before it comes to the oxide of iron.

Q. Does the oxide of iron take it out at all? A. I think it probably does hold a little ammonia. There is not much in the gas by the time it reaches the oxide of iron. The oxide of iron might withdraw a small quantity of ammonia if there was any in the gas.

Q. Before it left the purifier? A. Yes, sir, it might do it.

Q. Can't you say with certainty? A. I know there is an affinity between oxide of iron and ammonia, and, judging from that, I should suppose it would, and, moreover, the oxide of iron smells of ammonia.

Q. I understand from your testimony that you speak doubtfully of the entire removal of carbonic acid by Laming's method? A. I don't think there is so much doubt about the removal of carbonic acid by Laming's method. He don't use the hydrate of lime because he uses the hydrate of lime with the oxide of iron.

Q. Suppose it was subjected merely to the action of the oxide of iron without the hydrate of lime subsequently. What then with regard to carbonic acid? A. The removal of the carbonic acid would then depend on the possible action of the little ammonia which might be absorbed by the oxide of iron.

Q. Could the gas be subjected to the purification of hydrate of lime subsequent to the iron process, without serious detriment to the candle-power of the gas? A. I think it might.

Q. It has been stated that the iron process does not remove the carbonic acid completely. Is that so? Has it never been so stated? A. One of your chemical advisers, who is one of the persons that I understand you propose to bring in, has made that statement.

Q. Who do you refer to? A. Professor Wurtz.

Q. Have you not yourself so stated? A. I believe I did.

Q. Was it true? A. I gave it as an opinion merely.

Q. Have you any reason to change your opinion from that? A. No.

Q. Have you visited the New York Works? A. I have.

Q. Do you regard the Rev. Mr. Bowditch as good authority on the use of coal-gas, and the chemistry of coal-gas? A. I do, except so far as he has a process of his own for purifying gas.

Q. Is he not regarded as an authority? A. With that limitation, yes, sir.

Q. Do you say that there is no disagreeable odor or smell proceeding from the oxide of iron, after it has been used to purify the gas? A. There is not a sufficient amount of odor to constitute a nuisance, as I judge from my own experience.

Q. How much do you think it takes to constitute a nuisance? A. Enough to be offensive; it would probably make some difference what oxide-of-iron process is employed, as there are several.

Q. The oxide-of-iron process at the New York Works? A. That is the one I speak of when I say it is not offensive.

Q. Mr. Bowditch, in his work on coal-gas, states as follows on page 21, with regard to this process of purification with the oxide of iron: "That it has its drawbacks for consumers: 1. Because, since it came into use, much carbonic acid is left in gas, and thus its illuminating power is reduced; 2. Because when the fouled oxide is brought out to revivify, it gives off a quantity of very offensive compounds which seriously annoy those who reside in the neighborhood of works where fouled oxide is exposed to revivify in the free air instead of covered or nearly-closed vessels and chambers." Do you agree with Mr. Bowditch in that? A. I don't, nor do any of the authorities that I have consulted.

Q. To what part of it do you not agree? A. The nuisance of the revivification of the spent iron oxide.

Q. Is that the only part you don't agree with? A. Yes, sir.

Q. You don't disagree with him then in what he says in regard to the carbonic acid being left in the gas? A. No.

Q. The Rev. Mr. Bowditch says in his work as follows: "The aqueous vapors and the vapors of hydro-carbons, are much heavier than the atmosphere, and when evolved from the foul oxide by the heat of chemical action, they float in the lower stratum of the atmosphere near the surface of the earth and produce extensive annoyance." What do you think about that? A. The Rev. Mr. Bowditch makes a mistake. One portion of the statement is directly at variance with the facts of the case, for aqueous vapor is only two-thirds as heavy as atmospheric air.

Q. Would not the fog arising from these purifiers of oxide of iron be heavier than the air? A. If it was heavier than the air, it would not rise. So there is an inconsistency in your question which makes it difficult for me to answer it.

Q. The theory is that it remains floating in the lower stratum of the atmosphere near the surface of the earth; would not that fog arising from these purifiers float in the lower stratum of the atmosphere near the surface of the earth? A. That would depend on the condition of the atmosphere at the time as to the movement of the currents.

Q. Well, generally—the general condition of the atmosphere. We don't want exceptional cases? A. I can only answer from experience that there is not any marked accumulation of gases about the neighborhood of works using this process.

Q. Are not hydro-carbon vapors heavier than the atmosphere? A. Some are, and some are not.

Q. Those which are evolved from these purifiers (because I am only speaking about those, it is not in a general broad field)? A. I think they are, probably.

Q. How do you reconcile the assertion that has been made by the promoters of the iron process of the entire suppression of the disagreeable smell, with the wholly opposite statements made by other authorities? A. The only opposite assertions made by any other authority that I know of are made by the Rev. Dr. Bowditch, who has a process of purification of his own to recommend, and, as my own experience agrees with the statements of all the other authorities I have consulted, I am at a loss to account for the Rev. Mr. Bowditch's opinion.

Q. Then you know of no other authority than Mr. Bowditch who speaks of the disagreeable odors proceeding from the fouled oxide of iron? A. I recollect of no authority who speaks of them as at all a nuisance.

Q. Does not Clegg say the same thing, sir, with regard to the oxide of iron—of the disagreeable odors arising from it? A. I don't recollect that he does.

Q. He is a good authority, is he not? A. Certainly.

Q. You don't recollect that he speaks of such odors proceeding from the fouled oxide of iron? A. I have not consulted Clegg since last summer.

Q. Since your evidence was rendered have you heard any complaint respecting the quality of gas delivered by the New York Gas-Light Company throughout their district? A. I saw a complaint in the newspaper which emanated from the laboratory of the chemist of the Manhattan Gas Company. It mentioned tests made in his laboratory.

Q. Is that the only complaint you have heard of the quality of the gas? A. I have on one other occasion seen a statement in the newspaper to the effect that something had gone wrong at the gas-works, by which the consumers were deprived of their supply of light.

Q. Haven't you heard it stated, with regard to the gas, that it was not very pure gas, that it had sulphur? A. Only in this instance, which came from the agents of another Gas Company.

Q. Have you tested the gas delivered by that Company* for the purpose of discovering whether there was any, and if so, what amount of sulphur in the gas as delivered by it? A. I have.

Q. What was the result of your investigations on that subject, did you discover sulphur? A. I discovered sulphur every time.

Q. How often did you make those experiments? A. I have tested the gas on four or five different occasions.

Q. What method did you adopt to discover the presence of sulphur? A. The combustion method usually employed. I have also used test-paper repeatedly without discovering sulphuretted hydrogen.

Q. What quality or proportion of sulphur did you discover on that occasion? A. The quantity varied.

Q. The sulphur was there, I suppose. The occasion of the sulphur being there was on account of the imperfect method of the purification of the gas, was it not? A. All gas contains sulphur; gas is never perfectly purified.

Q. That is not the question. If it was perfectly purified, it would be taken out. The method of purification was imperfect, was it not? A. Yes, sir. It makes me tell something which does not represent the truth when you make me answer that with a single word.

Q. How much sulphur did you discover? A. I find I have more tests here. I said four or five times, but I had forgotten how many. The quantities of sulphur found in the gas varied from 21 to 45 grains per 100 cubic feet.

Q. That is more than is allowed by the English Parliamentary standard, is it not? A. Yes.

Q. The English Parliament allows what percentage in the gas? A. 20 grains.

Q. And, therefore, you found more there than is allowed by the English standard? A. Yes, sir.

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* The New York Gas-Light Company is the one here referred to.

Q. Now, I am going to ask you this question. You use the gas delivered by the Metropolitan Gas Light Company, do you not? A. Yes, sir.

Q. Have you tested it to see whether there is any sulphur in it? A. I have not.

Q. But you have used it in your house? A. Yes, sir.

Q. Have you discovered any sulphur in it? A. I know there is sulphur in it. I should state so, that I may not appear to misrepresent the facts of the case. I have made some experiments on the Manhattan and Metropolitan gas, but the results determined have not been weighed, so that I cannot tell the figures. The examinations have not been completed.

Q. You say that you discovered sulphur? A. Yes, sir, there is sulphur in both.

Q. As they deliver it now? A. Yes, sir.

Q. The gas delivered in your house you have not specifically tested to discover whether it contained sulphur or not? A. It was tested in my laboratory, but not in my house, but the quantity I have not determined in either case.

Q. It is appreciable, is it? A. Yes, sir.

Q. I am going to ask you as an expert from what you have known of these various systems of purification, and what you know of the subject-matter, as an expert would you advise the Metropolitan Gas-Light Company to adopt the iron process without very mature and deliberate inquiry and examination and experiments? A. I not only would advise them to do it, but I did advise them to fill their four purifiers with the iron mixture and give the thing a fair trial at once.

Q. You do advise them to do so? A. I do, and I suggested that they should do it.

Q. The question as I propounded it to you is whether you would advise them to adopt the iron process without mature and deliberate examination, inquiry, and experiment? A. I should. There are reasons why I should.

Q. I will allow you to give your reasons. A. These reasons are so trifling that it is scarcely worth while to put them on record.

Q. I should like to have them down? A. In the first place, I consider the iron process more economical. In the second place, it would do away with the cause of this hearing.

Q. That would be entirely satisfactory to the Board of Health? A. I am not at liberty to speak for the Board of Health, and I am not the prosecuting attorney.

Q. You think it would do away with the hearing? A. I think it would do away with the nuisance, and if it did away with the nuisance there would not be a cause of complaint. That is my opinion as an expert.

Q. Do you know whether the officers of the New York Company are not dissatisfied with this method of the purification of gas, and that it does not come up to their expectations in that regard? A. On the contrary, I know that they are pleased with the process.

Q. Did you ever know or hear of an employé or visitor in any of the gas-works being killed by the effluvia from the fouled purifiers? A. I think I have heard of such cases, but I could not say with absolute certainty that the sulphuretted hydrogen which killed them was from fouled purifiers, or some other chemical source. I have heard of persons being killed by escaped sulphuretted hydrogen, but I am a little uncertain whether it occurred in gas-houses or elsewhere.

Q. I did not ask you that. A. I am a little uncertain whether it occurred in the gas-house or where.

Q. Did you ever know or hear of an employé or visitor in any gas-works being killed by the effluvia from the fouled purifiers? A. I have heard of persons being killed by such foul gases, but I am a little uncertain whether it occured in gas-houses or not.

Q. Or on gas premises? A. Or on gas premises.

Q. Or that the vapor escaped from the manufacture of gas? A. Yes, sir.

Q. You can't say that it was. It may have been sulphuretted hydrogen formed under other circumstances? A. Yes, sir.

Q. Do not mineral poisons, where frequently administered, generally produce some specific disease—salivation, ulceration, etc., etc.? A. Some do, and some do not.

Q. Which mineral poisons do not? A. Salt—common salt.

Q. Otherwise, do you make any other exception? A. Yes, an indefinite number of exceptions.

Q. Mercury? A. Mercury, in a sufficient quantity, will salivate, certainly.

Q. Phosphorus? A. If you breathe enough of it, it will produce caries of the jaw.

Q. Lead produces diseases, does it not? A. Yes, sir.

Q. Palsy and colic? A. Yes, sir; and paralysis.

Q. Does not the bisulphide of carbon produce a similar disease? A. I can only speak from my own experience in that case; that I have been in the habit of breathing bisulphide of carbon frequently, and never suffered any injury from it.

Q. State, aside from your own individual experience as a chemist, how is it? A. Bisulphide of carbon is used so much for filling prisms, and employed by experimenters, and the fact that I have not known it to produce any ill effects, leaves me in doubt of its producing any. I have had it about my own house months together, so that you could perceive it in coming in the neighborhood of it, and never knew of any evil effects from it.

Q. In factories, haven't you heard of operatives getting disease from it? A. Never. I never read of it. Some of my old pupils are manufacturers of it too, and I know they do not suffer any injury from it.

Q. According to your own experience, are the employés in purifying-houses of gas-works subject to any special disease or diseases? A. They are not.

Q. Now, in the cases on record of the poisonous effect from sulphuretted hydrogen, was not the proportion in the air breathed very far greater than any ever occurring in a purifying-house, much less in its neighborhood merely? A. It was.

Q. Which do you suppose to be the worse—free sulphuretted hydrogen or sulphide of ammonium? A. I don't see much choice between them.

Q. You can't say which is the worst? A. No.

Q. Is there any? A. I can't say.

Q. Have you ever heard of any person being injured by sulphide of ammonium? A. I have not. It is a much rarer substance than sulphuretted hydrogen.

Q. Can there be really any sulphuretted hydrogen at all given off by the waste lime, considering that the predominant odor is that of ammonia? A. I could not answer that question.

Q. This is a bottle of spent lime taken from the purifier of the Metropolitan works. Now the question is, if you will tell us what is the predominating odor? A. Ammonia. The odor of the second one is that peculiar persistent odor of gas-lime, which has not been investigated to such an extent as to make it possible to state exactly what it is.

[The counsel produces two bottles of spent lime taken, one from the top and the other from the bottom of a fouled purifier of the Metropolitan Gas Works.]

Q. Is there ammonia there also, doctor? A. I think I perceive ammonia.

Q. Try it again. A. I think there is ammonia there.

Q. Is there not an excess of ammonia? A. I think there probably is.

Q. Try, doctor, long enough to know whether there is an excess of ammonia there. A. I think there is probably some ammonia there.

Q. An excess of it? A. I think so.

Q. Is there any doubt about it? A. I think not.

Q. You have subjected it to another test? A. Yes, sir.

Q. To what test? A. Turmeric paper.

Q. Doctor, can there really be any free sulphuretted hydrogen of the kind supposed to be thrown off by the waste lime, considering that the predominant odor is that of ammonia? A. Not until after the ammonia has escaped.

Q. Is there any evidence that there is any poisonous substance given off by that lime? A. Yes, sir, I think there is.

Q. What is it? A. I think there is sulphide of ammonium escaping from the mixture.

Q. Did you ever know of sulphide of ammonium poisoning anybody? A. No, I never did.

Q. Did you ever hear of anybody being poisoned by it? A. None.

Q. Then why did you say it is poisonous? A. Because it has such a disagreeable effect on my nose and lungs.

Q. Is not almost every human being subject every day more or less to the inhalation of sulphide of ammonium, or even at times sulphuretted hydrogen, from his own excrement? A. He probably is.

Q. Are scavengers who handle such matter subject to any special morbid condition? A. They are occasionally killed by the foul gases of the cesspools they enter.

Q. Are they subject to any special morbid condition? A. Would death come under that head? They are occasionally killed by the effluvia.

Q. That is the only answer you can give to it? A. Yes, sir.

Q. Is it not an accepted maxim that the effluvia from human excrements, unless putrid or tainted with a disease like cholera, never hurt any person? A. I never heard any maxim relating to it, but I never knew the fresh excrements to do any harm. After a short time they certainly do have that effect. We know that the camps during the war became terribly offensive from the accumulation of that sort of thing.

Q. Is not sulphide of ammonium a recognized constituent of the effluvia from such substances? A. I can only say that I have not paid especial attention to that department of science.

Q. What is the effect of leaving sulphur compounds in gas? A. That depends somewhat on what particular compounds are left in the gas.

Q. Sulphur compounds? A. There are different sulphur compounds; some have one action, some another.

Q. When the gas is burned? A. When combustion takes place they produce sulphurous acid and sulphate of ammonia.

Q. Is that first product of which you speak deleterious to health or not? A. Not in the small quantities which are evolved from the wholly purified gas.

Q. Gas that contains 21 grains? A. No, sir.

Q. Not injurious to health? A. No, sir.

Q. Nor detrimental? A. No, sir.

Q. Or to property? How does it affect property? A. Or to property.

Q. What was the experience in the early days before the lime process was introduced, in regard to the effect of gas-light on health and property? A. The enormous quantity of sulphur in the gas at that time was a source of inconvenience, I believe.

Q. Didn't it injure property, books, and maps? A. It was claimed that books suffered from it.

Q. Was not its use prohibited in the British Museum? A. I cannot say that it was.

Q. Is there not an especial danger pertaining to sulphurous acid gas, arising from its comparative freedom from odor? A. It is not comparatively free from odor.

Q. You deny the premises? A. I deny the premises. It has, on the contrary, a most suffocating odor.

Q. What is the effect of it upon your eyes, lungs, and mouth? A. In a concentrated form it is suffocating, and, in the small quantities which gas is liable to put in the atmosphere, it is inappreciable. I have not smelled or perceived the sulphurous acid, even from the most impure gas that I ever saw burned.

Q. Do chemists hesitate to expose themselves to sulphuretted hydrogen or sulphide of ammonium? A. Not when they are diluted.

Q. Do they hesitate to inhale sulphurous acid? A. Not when it is diluted.

Q. Do you make any distinction between them? A. No, sir.

Q. Do they hesitate any more to expose themselves to inhaling sulphurous acid than they do sulphuretted hydrogen or sulphide of ammonium? A. Only in so far as the sulphuretted hydrogen or sulphide of ammonium is more disagreeable when presented in small quantity.

Q. Are they as injurious as the other? A. In minute quantities, I consider that sulphuretted hydrogen and sulphide of ammonium are most injurious.

Q. What is the action of lime on the bisulphide of carbon in the gas? A. I don't know that it has any action.

Q. What is the action of oxide of iron on it? A. I don't know that it has any action; I answer your question, supposing you to mean at ordinary temperatures.

Q. The Rev. Mr. Bowditch says, in his work, on page 27: "At common temperatures hydrate of lime forms, with bisulphide of carbon, a very beautiful ruby-colored crystalline salt." Do you agree with the Rev. Mr. Bowditch in that? A. I have never examined the question.

Q. You don't know whether he is correct or not there? A. No.

Q. Do you know Berzelius? A. I have read him.

Q. Is he a good authority? A. Yes, sir.

Q. Berzelius says: "By digesting sulphide of calcium with an excess of bisulphide of carbon and water at 30 degrees in a glass vessel, a dark ruby liquid is obtained, and this, when evaporated in vacuo, yields a mass which is yellow, brown, and crystalline, at first, but assumes a pale-yellow color when perfectly dry." Do you agree with Berzelius? A. Yes, sir; I accept whatever Berzelius says, unless I know to the contrary.

Q. If you accept that, does it not necessarily follow that the lime-purifier extracts the bisulphide of carbon? A. It doesn't necessarily follow.

Q. Why not? A. In the first place, the conditions were not the same.

Q. If the conditions were the same? A. If the conditions were the same, and there was no other reason for some other change taking place, that might happen.

Q. What conditions are not the same? A. In the first place, Berzelius had an excess of water; he speaks particularly of the excess of water; that might or might not modify the reaction.

Q. I understand you to admit that the Rev. Mr. Bowditch states that at a common temperature hydrate of lime forms with bisulphide of carbon a very beautiful ruby-colored crystalline salt? A. I accept that substantially.

Q. Now, if you accept that, and if that is true, will not the lime process extract the bisulphide of carbon? A. It will probably extract a portion of it.

Q. Are you aware that the Metropolitan Gas Company scrub their gas copiously with cold water before condensing it? A. I am aware of it.

Q. I want you to say what effect has this scrubbing on the offensive compounds? A. It undoubtedly removes a portion of them.

Q. It carries them off, those at least which are condensable in water, into the tar-well? A. A portion of them, not all of them.

Q. That proportion of course is prevented from going into the purifiers at all? A. Yes, sir

Q. What effect would it have, for example, on the acetylene in the gas, would it not remove it? A. It would probably remove a portion of it; it don't take all of any thing out of the gas.

Q. Does it not take out the tar? A. A portion of it; the greater portion of it. I should qualify that, because a very small portion of tar goes to the water at all; it is separated before the scrubbing by water is resorted to, and I suppose it takes out a very small portion of the tar.

Q. Would not the washing with water increase the quantity of tar in the water itself which was extracted? A. The water would extract a little more, which would otherwise be left in the gas.

Q. Does not the tar contain all the offensive ingredients of the gas? A. It contains portions of most of them; that is to say, the impurities are not all in the tar.

Q. Then this scrubbing process does perform a very sensible office in the purifying of the gas? A. Yes, sir.

Q. And of course prevents them from going into the purifiers with the waste lime? A. Yes, sir.

Q. Otherwise, if they went into the waste lime there would be more work done there, and that process purifies the gas to that extent at any rate? A. Yes.

Q. The washing process, to a considerable extent? A. Yes, sir.

Q. If you put a woollen cloth or blanket in the atmosphere containing these foul vapors, will it not absorb and contain them for a considerable time? A. I suppose it would.

Q. Is there any doubt about it? A. No, I think not; I think it would.

Q. What are the properties of acetylene as to smell? A. I believe it has a disagreeable odor; but I never smelled it.

Q. Do you know what becomes of it when the gas is burned? A. I suppose it is burned in the gas.

Q. Do you consider Berthelot good authority? A. He is a noted chemist.

Q. Berthelot says that "coal-gas is no exception to this general rule—a rule that has been stated—as may be easily ascertained by observing the traces of acetylene which it contains in its normal state. It is produced and discharged into the atmosphere whenever an organic compound burns in contact with the air with the formation of lamp-black." Do you agree with Berthelot in what he says about that? A. I can only say that I have often perceived that odor which Berthelot attributes to acetylene, but have no other evidence in the matter.

Q. Berthelot says further as follows: "The same observations are applicable to the composition of coal-gas. The gases discharged into the air, whether by the flame of a burner known as the bat's-wing, or by the smoky flame of one of Bunsen's burners, contains a notable portion of acetylene." How does that agree with your experience? A. I have perceived the odor from the smoky column of Bunsen's burners, but I have not perceived it from any ordinary gas-burner used for illuminating purposes, when not improperly used.

Q. If these statements are correct, would you not object to gas as served, on the ground that it contained acetylene? A. No; I see no reason for objecting. My wife does not object to the tea-kettle apparatus on that account.

Q. Is it not probable that the presence of carbonic acid in the gas might interfere with its complete combustion, and conduce to the formation of acetylene and carbonic oxide and similar offensive or poisonous products? A. Yes, if present in sufficient quantity.

Q. I will ask whether the emanations from the spent lime are injurious to the health of the community in which they are evolved? A. I think they are, because they nauseate.

Q. Is every thing which nauseates injurious to the health? A. I think it is, unless a person desires to be nauseated for some other difficulties.

Q. And every thing that is nauseating is a nuisance? A. Yes, unless it is resorted to to produce a nausea for a specific object.

Q. Do you mean to say that you have been nauseated by the atmosphere of the purifying-house of the Metropolitan Gas Company, for example? A. Well, I am not enough of a medical man to say what nauseating is; but I have been highly disgusted by the smell, and that is what I have understood medical men to understand by the word nauseating. I have not actually been made sick at my stomach, but I have had those impressions which are preliminary to that feeling.

Q. Did you ever know any person that was nauseated—any chemist, by breathing in the laboratory the sulphide of ammonium? A. Nauseated in the sense which I understand it there, I have; the effect that a highly disagreeable odor has upon a person.

Q. Do you mean that these odors which escape from the spent lime are any thing more than that you have said was disgusting to you—do you mean that? A. I mean that they are highly disgusting, and what people call nauseating. I am not a physician, and do not pretend to be an expert in medical terms.

Q. You do not mean to say they are detrimental to health? A. I do, because I think it is detrimental to health to be constantly nauseated.

Q. You do not think that there is any thing poisonous? A. Any thing that produces that disagreeable effect is called a poison, and it is a poison.

Q. Have they the ability to create a disease as a poison does? A. The term poison is so indefinite, I should prefer to say I consider them injurious to health.

Q. Now I beg you to state why they are injurious to health, in your own language. A. Because they nauseate in the sense I have used the term.

Q. In no other sense? A. Not to my knowledge.

Q. Have they no fermenting properties? A. No.

Q. Most poisons have, have they not? A. No.

Q. How is the odor of roses to you; agreeable or disagreeable? A. In a moderate quantity it is agreeable, though not my pet perfume.

Q. You know that persons are made sick by the smell of roses, even in small quantities? A. Yes.

Q. The same way with regard to the smell of strawberries? A. Yes.

Q. Makes a good many people sick, does it not? A. Yes.

Q. And to others it is delicious? A. So I have understood.

Q. There is no doubt about that? A. I think not.

Q. You would not ask to have them suppressed because they are disagreeable? A. That is so rare.

Q. Have you not heard that there are whole peoples to whom the smell of roses is disgusting and oppressive? A. Never heard of it.

Q. In Italy, for example? A. Never heard of it.

Q. Do you compare these exhalations from the spent lime-purifiers with exhalations which are known to be poisonous in minute qualities—like miasmatic exhalations, or those from putrid organic matters? How is that, doctor? A. I do not compare them with those exhalations which are supposed to be organized, and develop specific diseases.

Q. Are not the latter believed to be of the nature of ferments or organized germs capable of reproduction? A. They are by many persons.

Q. Is mere foulness of odor indicative of poison? A. Poison is an indefinite term.

Q. Is mere foulness of odor, then, indicative of poisonous qualities, or as positively injurious to health? A. I think it is so.

Q. Which? A. I think foul odors are, as you say, injurious to health.

Q. As I understand you, you do not compare these exhalations from the lime-purifiers with the exhalations known to be poisonous, like miasmatic exhalations, etc.; you do not class them in the same category? A. No, sir.

Q. Will you please to state with what known substances or injurious properties you do compare them in giving them the character you have, which are injurious in excessively minute quantities? A. I compare them with sulphide of ammonium and sulphuretted hydrogen.

Q. I understand you to say that you never knew in your experience, or heard of any persons, who had been killed by breathing one or the other; or that they had ever incurred any disease by breathing it? A. I made that statement.

Q. Do you consider the British Association of Gas Managers a body qualified to consider the subject of the purification of gas? A. Undoubtedly.

Q. In the inaugural address of the president of that body, Thomas Hawksley, Esq., on the 11th June, 1867. Have you seen it, doctor? A. No.

Q. The president says, in that address, in speaking of purification, as follows:

"If there be one thing more injurious than another to the persons by whom gas is consumed, it is the presence of sulphur in any amount in the gas, at the place where it is employed." What do you think about that statement of President Hawksley's? A. I do not think President Hawksley is any more competent to judge upon that point than myself.

Q. He regards the presence of sulphur in any amount as injurious. Do you agree with him? A. I do not agree with that, unless he means the presence of a large quantity. If he means the presence of any sulphur, I disagree with him; if of a large quantity, then I agree with him.

Q. I will read to you from this same address of President Hawksley, as follows:

"I think we shall all be agreed in the desirableness of adopting some means, if such means can be discovered, for the removal of this noxious material. Permit me, then, to mention to you merely as a subject for your consideration—for you all know a great deal about it—that the use of oxide of iron, which is in itself a very valuable material for the ordinary purification of gas from sulphuretted hydrogen, is insufficient, and a great deal of the obloquy which has fallen upon gas companies during the last few years has arisen from the adoption of that material, in substitution for the old mode of purification. We all know that lime is very liable to, and in all ordinary cases does, give off an obnoxious smell in the neighborhood; but it, undoubtedly, has this property that, if it creates a smell by reason of its being kept on the gas-works, it prevents a much more serious smell in the houses of the consumers, for what you fail to take out of the gas by the oxide of iron in substitution for the lime, really goes into the dwelling-houses, and manufactories, and shops of the consumers, in the form in which I exhibit, combined of course with the gas, but still, in every thousand cubic feet of gas there is a large quantity of sulphur to be burned in the interior of the building where the gas is distributed. Under these circumstances, great attention has been paid to the elucidation of a better chemistry on this subject, and it has been ascertained by Dr. Letheby, as the result of a great number of experiments, made upon a very large scale, a considerable portion of which were conducted in the town—that whereas by the use of oxide of iron, you cannot remove the whole of the sulphur, but must leave in the gas from 20 to 25 grains in every 100 cubic feet, yet, by the use of lime alone, you may reduce that quantity down to less than one-half; in fact you may reduce it down to from 10 to 12 grains."

Now, Dr. Chandler, the question about these extracts is, whether you agree with the president in these statements? A. There are so many statements there—while I agree with some, I do not agree with others.

Q. State what you agree with, and what you do not agree with? A. I agree to the probable effect of lime in removing more sulphur than is removed by the oxide of iron, but on the other hand, I consider what is said about the effect of these few grains of sulphur, more or less in the gas, to be highly ridiculous and absurd; and am supported in this by the opinion of prominent chemists.

Q. Does that sulphur have the effect to nauseate? A. Not in the maximum quantity which occurs in the gas; it will not have the effect to nauseate.

Q. Do you not know that the British Parliament have passed an act in which it was provided that the gas delivered shall be freed from these small quantities? A. They have passed such an act; and they have passed a great many other ridiculous acts—the "Stamp Act," and several others.

Q. Then you regard the act of the British Parliament as a sanitary measure, in the same light that you do the act of the British Parliament imposing "stamp duties?" A. I do not say it. I say it does not follow that, because the British Parliament fixes it at 20 grains, that it was necessarily the proper limit. I know that the reason that led them to fix it at that point was insufficient.

Q. You say that, notwithstanding all that you have said, the lime process of purification is the process which is in use in all the large cities of the United States? A. Yes.

Q. Including the city of Philadelphia, the gas for which is manufactured and purified by the municipal corporation itself? A. Yes.

Q. Where does the purification of gas by the iron process prevail? A. In all the large cities of Europe.

Q. Are you not aware that, in communities where this process of purification by iron has been adopted, it has proved to be a failure, and that the companies that have adopted it, are, in many instances, abandoning it, and are returning to the lime process of purification. Have you not been so advised? A. I have been advised that the iron process is still in use on the Continent of Europe; but that, owing to this foolish law of the British Parliament, the gas companies have been so hampered—the iron process not allowing them to keep within the act—I have heard that, on that account, they would return to the lime process.

Q. As a process which would enable them to deliver gas of the purity required by the act of the British Parliament? A. Yes.

Q. And will you not say as an expert, that the lime process does deliver a purer gas to the consumer than the process of the oxide of iron? A. I think it does.

Redirect examination of Prof. Chandler was deferred.

TESTIMONY OF PROFESSOR BENJAMIN SILLIMAN, OF YALE COLLEGE.

Professor Benjamin Silliman, Jr., called for the Metropolitan Gas-Light Company, being duly sworn, testified as follows:

By Judge Van Voorst.—Q. State, if you please, your profession. A. I am a chemist, residing at New Haven, and have charge of the department of general and applied chemistry in the Academical Department of Yale College. I have been connected with the institution since 1847, as a professor, and since 1838, as a teacher.

Q. Have you given particular attention to the subject of the manufacture of coal-gas? A. I have been practically familiar with the manufacture of coal-gas for about twenty years.

Q. Have you studied the subject of its purification? A. I have.

Q. And have observed it practically? A. I have observed it practically.

Q. What is the method of purification of gas in use in the United States, as far as your knowledge and experience goes in that subject? A. The usual method of purification of gas in the United States is what is familiarly known as the dry-lime process, in which the hydrate of lime is employed; and there is in use in a few companies what is known usually as the wet process, in which the gas is first passed through a salt of iron, green vitriol, and then through milk of lime under pressure, under weight of machinery. I might further answer your question by saying that, so far as I know, there is but one company in the United States that employs the iron process, which is the usual process in Great Britain and on the Continent of Europe.

Q. What is the company you speak of? A. I think it is called the New York Gas-Light Company. It is the old company. I visited their works last summer.

Q. You have visited the Philadelphia companies' works? A. I have visited the Philadelphia companies several times.

Q. You have witnessed their processes? A. Yes, sir. I have been familiar with several gas-works, particularly Boston, Worcester, Hartford, New Haven, and Louisville.

Q. Have you been in Prof. Smith's establishment at Louisville? A. I have, recently.

Q. Since his return from the World's Fair? A. It was about the first or second week in September I was there. He uses the dry-lime process.

Q. You have witnessed the purification at the New York works. What, in your opinion, is the best mode of purification of gas? A. I have no hesitation in saying that, if it is properly conducted, the dry-lime process offers by far the best means of purification.

Q. Why? A. For several reasons: first, because it does effectually remove all the sulphur which is in a state of chemical combination, such as is capable of being removed on a large scale by any known process. I might make an exception of Dr. Bowditch's method. I know nothing about his method practically. I except, of course, in this generalization, the sulphur combined in such forms as to escape the ordinary tests employed to indicate its presence. Second, this process does effectually remove the carbonic acid, which no other known process does remove.

Q. Any other reason, professor? A. I do not think of any other. As regards ammonia, I do not know that it is more efficacious than other processes, and believe it is less efficacious than the process of wet lime with the salt of iron, which does remove all the ammonia.

Q. The most deleterious substance or element to which your attention is directed in purifying the gas—does it not seem to be sulphur? A. Yes, sir. In its various forms of combinations, it is the black beast of the coal-gas manufacturer.

Q. And which you seek to eliminate? A. And which we seek to eliminate. You will observe I made an important distinction. I said if applied with suitable precaution.

Q. It more effectually removes the sulphur? A. More effectually removes the sulphur than any other available process.

Q. What objection, if any, exists to the dry-lime process? A. The objections to the dry-lime process are twofold: first, that the material is exhausted, and to a great extent lost, in respect to its value in the act of purification, and that no process has yet been discovered by which it can be restored to a condition to purify gas again. That is a loss which falls upon the company.

Q. Any thing else? A. Second, that this accumulation, as an effete waste product about the gas-works, as ordinarily conducted, constitutes a just ground of complaint as a nuisance, using the term nuisance in the sense of that which is offensive.

Q. Offensive to the smell? A. Yes, sir. I classify nuisances under two general heads—those which are offensive to the sense of smell, and as such repulsive to our sense of taste, others which are deleterious and noxious as regards health. In the first class I would arrange gas-works and stables among causes of that kind; and in the second I would place all such nuisances as bone-boiling establishments and glue establishments, and others where putrescent animal matter is the subject of treatment; which are decidedly and confessedly injurious to public health.

Q. You do not consider the emanations from the gas-works of which you have spoken, as deleterious to health? A. Long familiarity with the management of the New Haven Company, with which I have been associated as a director, has satisfied me that no injury to health—no bodily injury—attaches to the use of dry lime. By diligent inquiries, the only complaint I have heard was, some irritation of the eyes of the persons about the boxes, when they are opened. That proceeds from the ammonia and is entirely transitory. On the contrary, parties living in the immediate vicinity of these works have always asserted that they have enjoyed excellent health.

Q. Then you do not regard those exhalations or emanations as deleterious to health? A. I do not. I should like to distinguish, however, between the classes of emanations which are given off in the decomposition of effete lime. I would call your attention to what seems to me an important distinction that exists between two quite distinct groups of exhalations, viz.: that the first effect of the atmospheric air upon the effete mass is an effect of oxidation, resulting in a state of high temperature, the whole mass of the effete lime becoming so hot that you cannot conveniently bear your hand in it, and this process of oxidation accompanied by the production of watery vapor and free ammonia, which exercises a stimulant effect, such as is due to this active agent; and, second, an entirely distinct class of effects is that which arises from the gradual separation, at a later stage of the process, of highly-offensive hydrocarbons, probably containing sulphur as one of their constituents, and characterized by an extremely persistent odor. This latter class of odors I have observed is not developed in the earlier stages of the decomposition of the mass. There is always to be perceived during the process of oxidation, as alluded to, the odor of sulphuretted hydrogen escaping from the decomposition or combustion of the sulphide of ammonium; but this odor of sulphuretted hydrogen or sulphide of ammonium, is restricted to a radius of limited extent—measuring from the purifying-box as a starting-point—and soon disappears. I have here some samples of lead-paper, which illustrate this remark. There, sir, is a sample of lead-paper, prepared this morning, in the yard of the Metropolitan Gas Company, by exposing the paper, when moist, to the atmosphere of the yard, at a measured distance of forty feet from the building, and in close proximity to one of the telescopic holders of the yard. Here is another lead-paper, prepared in precisely the same manner, which was exposed at a distance of sixty feet from the windows of the purifying-houses, the wind blowing from the direction of the house strong over the paper. Here is another paper of precisely the same kind, which was exposed at the measured distance of seventy feet from the same point. All these measurements were taken from the same point; and here is a fourth, at a distance of seventy-five feet northeast. I think you will perceive distinctly a diminution of the intensity of the action of these sulphur compounds with this moderate increase of distance. The last is very slight—scarcely perceptible.

Q. At a distance of seventy-five feet from the works, the wind blowing from the purifying-house, it scarcely discolored? A. It scarcely discolored the lead-papers. I should remark that these lead-papers were all exposed in a moist state, and remained there exposed until they had dried off in the wind, which was about fifteen or twenty minutes.

Q. You mean that the sulphide of ammonium evolved from the lime was so diffused at that distance that it made a very slight impression upon the paper? A. Yes, sir. Another very characteristic odor of the effete lime—spent lime—is that which is attributable to naphthaline—a substance which is always found to a greater or less extent in connection with spent lime, and which develops itself frequently in the latter stages of the decomposition—some weeks even after the material has been exposed to the action of the air. This beautiful pearly and micaceous substance appears in brilliant crystalline plates, lining the cavities or covering the surface upon the spent lime, and its odor is, likewise, clearly perceived at an early stage, when the box is first opened. The odor of naphthaline is agreeable to me. It is employed in small quantities as a perfume. I will exhibit some samples I picked out of a heap this morning from the pile of spent lime which had been exposed some three weeks. You will see that it is perfectly filled with those beautiful scales of naphthaline.

Q. You were there at the Metropolitan Works when the purifiers were opened? A. I was.

Q. This morning? A. Yes, sir. They had one opened specially for our inspection, and which had been running, I was informed, forty-one hours prior to the time when we saw it opened; and that there had passed in that time, by the registration of the station meter, one million feet of gas.

Q. What was the state of the atmosphere there this morning, when you were there? A.

The outer atmosphere was bright, and clear, and cold. The atmosphere of the room, before the box was opened, was not disagreeable; and, when it was opened, there was an odor of naphthaline, and, for some little time, I could perceive nothing else. Very soon, however, the powerful action of oxidation set in, and the lime began to give off vapor of rather a strong odor of ammonia, overpowering every thing else.

Q. Is ammonia deleterious to health? A. It is estimated the reverse.

Q. It is a stimulant? A. Yes, sir. Administered to revive fainting persons.

Q. Was there any sulphide of ammonium present? A. Undoubtedly.

Q. How much? A. It is impossible to form any more than an empirical judgment as to that. The nose is a poor analyst. Undoubtedly there is a large quantity of sulphide of ammonium.

Q. In this connection, now, I will ask you, what are the objections to the iron process of purification? A. The principal objection as I conceive to the iron process, is, that it is less efficacious, in general, as a means of purification than lime. It does not so efficaciously remove the free sulphur. It does not effectually remove the carbonic acid. It does not effectually remove the ammonia.

Q. It does not effectually remove the phenol? A. That I cannot speak of from my personal knowledge.

Q. State the objections to the process? A. There is this principal objection: I conceive that in every Metropolitan Gas Works it is the bounden duty of the company to exercise all possible dilligence to avoid the nuisances which are sure to manifest themselves, whatever agents may be employed for purifying; and, for this purpose, there is no means hitherto discovered that appears to be so efficacious as the method of ventilation, which has been recently adopted by the Manhattan Works in this town, and this process of ventilation appears to be inapplicable to the iron process for the important reason, as it appears from the writings of Mr. Clegg and other English authorities, that the heat generated by the active chemical efficiency of the oxygen is created in such an amount as to heat the mass to redness and set fire to the wooden screens and destroy the apparatus; while, in the case of spent lime, ventilation restores it to a condition inoffensive to health, and leaving a product which, as I conceive, has high value for agricultural purposes. I shall present a specimen of spent lime which I took from one of the boxes of the Manhattan Works, which represents fairly the mass of the material as it exists in the boxes. There is a feeble odor slightly of ammonia and slightly of gas-tar, but it is not an offensive material. I speak of it in a large way. It consists chiefly of sulphate and sulphite of lime, with some free lime, called hydrate of lime, and carbonate of lime; and is, therefore, a mixture which the agriculturists may employ with great advantage as a fertilizer, which is not true of the spent lime—of the dry-lime process, as it is ordinarily sold by gas companies for such uses.

Q. What odors does the effete iron give forth after it has purified the gas? A. My recollections of the visit which I paid to the New York Company, last June or July, are not very distinct; but my recollections are that the mass smelt of ammonia, and that there was, also, to some extent, the usual familiar odor of the gas-house, but decidedly to a less extent than in case of the lime purification.

Q. Were they nauseating or disgusting in their character—did they have that tendency? A. I could not say that they had; at the same time I ought to state, in that connection, that my attention was not so much directed to any question of the sanitary effect as to the economic one as affected by the iron process in place of the lime process. I went there expressly as a director of the New Haven Company—in that point of view.

Q. You concluded not to adopt it? A. Concluded not to adopt it. I was not satisfied with the degree of purification of the gas.

Q. Do I understand you to say that the oxide of iron fails to eliminate the sulphur in the various forms in which it exists in the gas? A. Not in so broad terms. I say that it fails to eliminate it to the same extent as lime does.

Q. Have you observed, since you have been in New York, the gas delivered by the Metropolitan Gas Company? A. I have this morning, and measured it with the photometer. I also tested it with lead-paper to determine the presence or absence of free sulphur compounds, and found none.

Q. Is there not, as yet, much obscurity in the minds of chemists generally, about the complete nature of the action of the lime—the complete composition of the waste and the effluvia therefrom? A. I do not know of any thorough chemical research upon the whole subject of purification of gas; and certainly think there are many important questions connected therewith that need further examination.

Q. In a sanitary point of view, do you think the purification by the oxide of iron has any advantages over the lime process of purification? A. Not if the lime process is conducted with suitable precaution; on the contrary, I conceive that, in the aggregate, the annoyance and injury to property which results from impure gas—

Q. I am speaking in a sanitary point of view. A. It affects the health. The respiration of air in a close room affects the eyes and the organs of respiration by reason of the presence of sulphurous acid, or sulphate of ammonia, or both, which may be present, which are given out in the process of combustion, and which ought to be removed, in great measure, in the purifying-house.

Q. In a sanitary point of view, comparing these two processes of the purification, and the quality of gas delivered by them respectively, do you not give the preference to the lime process of purification over that of oxide of iron? A. With the same explanation as before—that the lime process, conducted in a proper manner, I think, is capable of producing the best results for the public good.

Q. State, if you please, what is your own personal experience in regard to the burning of gas charged with sulphur, in a close room? A. I have often observed that, upon placing my head in an elevated position, as upon a step-ladder, or any other means of reaching the upper portion of the room where numerous gas-lights were burning, there was a very decided irritation to the organs of respiration, and to the eyes; and resulting as I conceive (and know in fact) from the production of ammoniacal salts, and of sulphurous acid. I find ammonia to be a much more frequently-occurring impurity in gas than most writers report.

Q. Is not sulphide of ammonium a very unstable, perishable, and transient substance in the air? A. I have reason to suppose that sulphide of ammonium is rapidly oxidized by the action of the atmosphere with the production of free sulphur and water, of course.

Q. Is not sulphuretted hydrogen quickly destroyed by the air? A. It is. I have observed that, in visiting the natural sources of sulphuretted hydrogen, such as the famous baths in the neighborhood of Rome, and other lakes and springs, the odor of sulphuretted hydrogen does not penetrate, nor is it carried to any great distance from the springs.

Q. Is there any sulphuretted hydrogen concerned in this case at all? A. No, sir; I cannot conceive of the existence of sulphuretted hydrogen, as such, in a free state, in presence of an atmosphere so highly charged with free ammonia as we find that to be where a dry-lime purifier is freshly opened, and the process of atmospheric oxidation has set in. I might add in that connection the sulphur compound which affects the lead-paper I conceive to be, generally, if not exclusively, sulphide of ammonium. This lead-paper is the only guide which the gas-maker employs to determine when the gas is sufficiently purified to be sent to the consumer, purified from the sulphur, of course.

Q. Did you ever know or hear of an employee or visitor in any gas-works being killed by the effluvia of the fouled purifiers, or injured thereby? A. Never.

Q. What is the state of health of those persons who are concerned in and about your purifying-house, in the New Haven Works, and other places? A. I think I have answered that question. I should say in general that I have always made diligent inquiries wherever I have been about the health of the persons employed about the purifying-houses, and the answer has always been that their health was excellent.

Q. You do not know that they are subject to any particular diseases? A. No, sir; there is a prevalent opinion, which may be worthy of record, that, in times of epidemic disease, such as cholera and yellow fever, they do not prevail in the vicinity of gas-houses. I heard that opinion expressed very confidently in New Orleans twenty years ago, where the yellow fever is very prevalent.

Q. What do you attribute that to? A. I conceive it must be attributable to the specific medical effect of some of the products of the distillation of coal, of which I would name carbolic acid, which is the same thing as phenol, as the most perfect representative of that class of agents which are most destructive to the spores and germs of fermentation of fungoid growth to which some physicians, with some confidence, attribute epidemic diseases.

Q. Has the presence of sulphur any thing to do with it? A. Sulphurous acid is well known to act in the same manner as an efficient agent in the destruction of germs and spores which produce ferment and disease; and sulphur itself, as such, is largely employed for the destruction of mildew. I do not know that sulphur or sulphurous acid, either, in this case of gas-works, has any application.

Q. Are the emanations or exhalations from the spent lime, when the purifiers are opened, poisonous or deleterious to health? A. I should say, decidedly not deleterious to health—that would open the question of what you mean by poison.

Q. Deleterious to health? A. I think a man would speedily be killed in an atmosphere of pure ammonia.

Q. Whether the process of manufacture of gas by the Metropolitan Gas Company, as you have observed it, gives forth any deleterious gas or odor detrimental to health? A. No.

Q. How would you compare those exhalations or emanations from organic substances which produce those disagreeable odors which you speak of as from bone-boiling houses? A. I can say that, in all cases where putrescent animal matters are undergoing transformation, there are emanations which may be, and in many cases probably are, decidedly detrimental to public health. It is well known that those emanations excite putrescence in other substances, causing milk to pass rapidly into acetous and putrefactive fermentations. I have no doubt that a carcass, as of a sheep, hung up in the purifying-house of a gas-works, would escape putrefaction very much longer than when hung within a short distance of one of those sources of animal contamination, or even a tenement-house. It is well known to chemists that animal substances are prevented from passing into a state of decay by being simply exposed to gaseous exhalations of gas possessing antiseptic properties, such as sulphurous acid and phenol, and carbonic oxide. It is well known that meats or dead bodies washed with phenol escape for a long time the action of putrescence, and for the same reason coal-tar is an antiseptic, because it contains several of these substances.

Q. I ask you this: whether you observed, in the neighborhood of the Metropolitan Gas-Works, any causes which would be likely to produce these contaminating or deleterious odors of which you speak? A. When I went down Forty-second Street this morning, before I reached the works, the wind blowing strong from the water toward me, I perceived very decidedly the odor of decomposed animal matter. The familiar odor of bone-boiling or fat-houses, or piggeries, or all combined. I did not know what source it came from, but I called the attention of my companions to the fact that there was a stench which many persons in their ignorance might attribute to the gas-house, which was not far off, but I was very particular to remark that it was clearly attributable to some cause to me unknown, like the house or manufactory alluded to. I was informed that there were, in that direction, below me, places of that kind—I believe a piggery or bone-boiling place, but I did not visit them.

Q. How soon after reaching Forty-second Street did you notice these odors? A. After I left Tenth Avenue, I noticed it before we had passed one hundred feet. It evidently proceeded from the direction of the wind, which was blowing out of the southwest at that time.

Q. And had its origin in decomposing or decomposed animal substances? A. It so addressed itself to my senses.

Q. And it had none of the properties peculiar to gas or its manufacture? A. None whatever.

Q. And those you would say were of a character detrimental to health. A. Such I conceive to be detrimental to health.

Adjourned to Saturday, February 13th, at 10 o'clock.

CONTINUATION OF THE HEARING BEFORE S. C. HAWLEY.

Professor Benjamin Silliman, recalled. Examination resumed by Judge *Van Vorst:*

Q. Professor Silliman, you spoke about having visited the Gas-Works in Boston, Philadelphia, and in some other places—state, if you please, in what part of the city those gas-works are located, as to their being surrounded by population? A. The densely-peopled part of the old town of Boston is the location of the gas-works there.

Q. How in the other places? A. The Northern Liberties Works in Philadelphia, which is an independent corporation not owned by the city, is also in a densely-settled portion of the town; there are, at present, I believe, three distinct gas-works in Philadelphia, not under the management of the corporation; I have not visited all of these; but one of them, certainly, is in a thickly-settled portion of the city. The Manhattan Works, as every one knows, is in a very densely-settled part of the town; so are the old works of the New York City Company.

Q. You mentioned that, in the gas delivered by the oxide-of-iron process of purification, there was remaining the element of sulphur, the same having been imperfectly extracted? A. I stated that the iron process failed to remove sulphur to the same complete extent to which the dry-lime process removed it; but there is some remaining—a portion of what is not called the free sulphur—which would not have been there, if the other process had been adopted; that, I beg to say, is entirely independent of any chemical combination in the gas, which makes its appearance only when the gas is burned.

Q. That is not developed until combustion takes place? A. No, sir. The other is that which is in a state of such chemical combination, that it gives to the gas manufactured an ocular evidence of its presence by staining the lead-paper.

Q. Can that be discovered by testing it with lead-paper in a dwelling-house as it comes from the pipes? A. If the gas is imperfectly purified.

Q. What, if any other defects, are there incidental to the oxide-of-iron process of purification—state them if you please? A. I can conceive a greater objection to the iron process than the small residue of sulphur which is left: it is to be found in the carbonic acid, which the iron fails to remove from the gas. It is well known to all who are familiar with gas, that the presence of this small proportion of carbonic acid greatly reduces the illuminating power of the gas; and that it also, in a corresponding degree, diminishes the temperature of its combustion; I consider this a great defect, for two reasons: that, in the first place, it is the bounden duty of all gas companies to render to the community the best possible illuminator, and they fail in their duty when they fail to do this; second, the presence of the carbonic acid, alluded to, involves another danger, namely: the imperfect combustion of the gas, with more or less acetylene and carbonic oxide, or oxide of carbon; the carbonic oxide is one of the most poisonous of gases—far more so, one hundred times more so, Dumas says, than carbonic acid, which is commonly reputed a poisonous gas.

Q. Where the oxide of iron fails as a purifier, in this regard, the lime process succeeds? A. The lime process is perfectly successful in the removal of the whole of the carbonic acid; and, if it fails to do so in any case, it is simply from a slovenly application of the method; I can conceive that this feature of the iron process is its essentially weak point.

Q. Would you, as an expert, and chemist, advise the Metropolitan Gas-Light Company to do away with the lime process of purification, and adopt, in preference to it, the oxide-of-iron purification, for any reasons? A. I could not say; I should like to add a qualification to that: provided, the Metropolitan Company take all needful and proper precautions to avoid the just causes of offence and complaint which exist against the lime process, when not carefully conducted.

Q. You have ventured that modification in your answer, and I, therefore, will ask the question of you: what improvements could you suggest to the Metropolitan Gas-Light Company, in the way of the manufacture and purification of gas? A. Granting that the surface area of their lime-purifiers is adequate to their daily production of gas—which is a point about which I am not fully satisfied—the one important thing needful for them to do, to avoid all just causes of complaint, is, in my judgment, that they should adopt a system of ventilation by atmospheric air, drawn by an exhauster through a box containing the spent lime after its cover has been raised, so that the atmosphere may have access, and before the process of oxidation—previously described at our last session—has set in, and the conveyance of the contaminated atmosphere drawn by the exhauster to another set of lime-boxes charged with ventilated lime, which lime has been found, by a frequent experiment—a constant daily experiment at the Manhattan Works—adequate to the complete absorption of all the offensive odors which are, otherwise, exhaled into the atmosphere. This process, properly conducted, leaves the lime in the exhausted box, in a condition of sulphate, or sulphite of lime and carbonate of lime—with a portion of unexhausted hydrate of lime, which is always present to a noticeable extent; this mixture is completely inoffensive; and may be left exposed to the atmosphere, without annoyance to any one, and constitutes a valuable fertilizer which may be safely applied at once, in the business of agriculture; whereas, as is well known, the ordinary spent lime of gas-works requires a long process of exposure, in order that it may not be rather injurious than beneficial to the farmer.

Q. What is the quality of coal that the Metropolitan Gas-Light Company uses in the manufacture of gas? A. I made particular inquiry last week, when at the works, with reference to this matter, and I found in their sheds the best qualities of bituminous coals. They were using, at that time, as their stock-coal, the Westmoreland, of Pennsylvania, which the best manufacturers of gas are pretty well agreed is one of the best coals accessible to the Atlantic border. They use, also, the Boghead cannel, which is universally esteemed as the richest of all the enriching coals. They had, also, the Lesmabago cannel, which stands next in commercial value and in illuminating power, to the Boghead. They had, also, several other of the more esteemed varieties of the European cannel coals, but, as I understand from Mr. White, the chief engineer, they were depending chiefly, for the enriching of the quality of the gas, upon a mixture of Lesmabago and Boghead. I failed to mention by name one of the other coals which should be mentioned particularly, as it is in constant use there—the well-known Wigan cannel.

Q. What length of time would it take for the purpose of making those improvements that you suggest for the ventilation of lime? A. Those improvements would require the construction of another house to contain the oxidating boxes; and its construction, with the necessary underground works for the exhausters, I should think would require two or three months. That question, I should think, is one which would be better answered by the engineer of the company; for the conditions under which the work can be done may require that it be done in the summer—that is, it may not be possible to do it while the ground is frozen.

Q. Do you know B. Howard Rand, Professor of Chemistry in the Philadelphia College of Medicine, and lecturer upon chemistry in the Franklin Institute? A. Yes, sir—he is well known. I am not certain as to his being in that institution.

Q. What is his reputation as a writer and lecturer on chemistry? A. He is a good chemical authority.

Q. I have before me an answer of Mr. Rand's, in these words: "I do not believe that the odors arising from the refuse water and the other residuary products of gas manufacture are, or may be, injurious to health when the dry lime is used in the purifiers, and is then exposed to the air and light. Sulphuretted hydrogen or hydro-sulphuric acid gas is disengaged. When the well containing ammoniacal liquor is allowed to remain uncovered, ammonia and hydro-sulphate of ammonia are given off. That these gases, however, although offensive to most persons, cannot be considered as causes of disease, or injurious to health, when freely diluted, is shown by the fact that the men, engaged in removing night-soil as a nightly occupation, do not suffer in health, although exposed to these very gases in a far more concentrated condition than they can exist from the causes already named, and mixed with organic emanations of an equally offensive nature, which would certainly aid the injurious effect of these gases, did any such exist." Do you agree with Professor Rand? A. I do in the main. I might not agree with the exact transformation he speaks of, but, in regard to the sanitary effect, I have expressed myself to that effect in the testimony given last week. I wish to say in this connection that I do not think the permitting of the escape of those effete products, in densely-peopled regions, is not a just cause of complaint as an offence against the nostrils of the community. This is quite another question.

Q. I am speaking of the matter as to their deleteriousness to health. A. I do not consider them deleterious to health—they may be annoying to comfort.

Q. As to the truthfulness of any charges which are made in regard to the emanations from the Metropolitan Gas Company, as being injurious to the health of the neighborhood—and especially to young persons and such—is there any foundation for such charges? A. I do not believe there is any just ground for any such charges.

Q. You have seen nothing to justify them? A. I have seen nothing to justify that allegation.

Cross-examined by Mr. Hastings, assistant-attorney for the Board of Health:

Q. You stated, in your direct examination, that you had been practically familiar with the manufacture and purification of gas for about twenty years, and had studied the subject of its purification, both theoretically and practically—please state what processes of purification you have studied practically. A. My practical experience with the purification of gas has been chiefly with the dry-lime, but I have also had some familiarity with the wet-lime purification, and I have inspected the iron process.

Q. Did you ever study Laming's process practically? A. No, sir; Laming's process has been brought into general use since I was in Europe, and I have not had an opportunity to examine it practically—meaning by that, studying it in the gas-works; I have been familiar with Laming's process as a student in the science of gas purification.

Q. Did you ever study the iron-ore process, as used in England, practically? A. No, not practically in the works.

Q. Have you a practical knowledge of any iron process? A. Not of my own experience.

Q. Then your practical knowledge is confined to the lime process? A. My practical experience—personal experience, as an administrator of gas-works; so far as I am advised, there is but one, possibly two works, in this country where the iron process is in use; one of these, and the most important, I have examined, but not, in the proper sense of the word, practically, as I have not abided there for the purpose of studying it, day by day, as I should do if I was in charge of the works.

Q. If not acquainted with the iron process, do you consider yourself fully competent to advise with regard to its use? A. I do; I do not conceive it is necessary for me to have spent months in the gas-works in order to reach a safe and trusty judgment; the processes involved in it are perfectly plain and obvious to any chemist; the objections which exist against it I have already stated, and they are such as must meet the assent of every chemist; they are inherent in the very nature of the process. It is a most excellent process up to a certain point, but it fails beyond that point. The English companies have been compelled by law into its adoption; but I know, from my reading and familiarity with gas engineers and gas literature, that they would gladly return to the lime process, if it were practicable for them to do so, in densely-peopled centres like London; but that there are practical difficulties attending the use of the lime process there, every gas engineer is perfectly free to admit, practical difficulties growing out, especially, of getting rid of the waste. The iron process offers to the gas companies the important advantage of economy in the administration of their affairs, in that they have not the daily-recurring expense of purchasing new quantities of lime, and disposing of it, and, perhaps, at a loss; for, when they have once got their stock of iron on hand, it is revived by the oxygen of the air and the chemical transformation, as already explained; and the expense is therefore reduced to the manual labor of handling the material.

Q. This is an advantage to the companies, but it is not necessarily an advantage to the community. What are the practical difficulties in its use, that you refer to? A. Of the iron process?

Q. Yes, sir. A. I have already stated those in my direct testimony as being, especially, the failure of the iron process to remove the carbonic acid.

Q. Give us the outlines, if you please. A. That it fails to remove, as perfectly as lime does, the sulphur; and that, in leaving a considerable portion of the carbonic acid in the gas, it not only abases the illuminating power, but reduces the temperature of the combustion, involving the risk of production of carbonic acid and acetylene.

Q. As a general rule, does not a practical acquaintance with any process tend to correct or modify views you may have formed in advance of its adoption? A. I entered on the study of the iron question without the slightest prejudice in its favor or against it. It is, undoubt edly, true that a practical familiarity with any process may tend to remove objections which are not well founded, but it cannot remove objections which are real and inherent, and in the nature of things. Nothing can alter the properties of carbonic acid.

Q. Not having tested the iron process in its various combinations, are you able to state that the objections you name are well founded? A. On general principles, yes, sir. I agree perfectly that if the lime process is made supplementary to the iron process to such an extent as that the carbonic acid shall be absorbed by lime, then the good effects of the two processes may be combined; but that is attended by another and very serious objection of a practical nature, irrespective of expense, and that objection is, that the gas suffers a needless loss of its illuminating power. It is a perfectly well-accepted principle, among gas engineers, that over-purification is a fatal error in the manufacture of gas. It is perfectly well known to chemists who are familiar with this subject, that the illuminating power of gas lies within exceedingly narrow limits, and that the volatile hydro-carbons which are held in a gaseous state in an elastic form in gas, belonging to the olefiant-gas series, are very easily removed from gas by over-purification.

Q. In your statement, that over-purification is a fatal error, you restrict it to the illuminating properties of the gas? A. Yes, sir, certainly—the illuminating properties of the gas. It is very well agreed now, among gas engineers, that that error has consisted to a too great extent in the scrubbing of the gas with the water—that the prolonged contact of gas with water, in scrubbing, has had the effect to remove too much of the illuminating power; and the purification process has been seriously modified by the best gas-engineers, in the recent times, in the omission, to a certain extent, of the scrubbing.

Q. Does not the scrubbing process tend to remove the offensiveness of the gas? A. Undoubtedly, but it may be carried too far, as already indicated.

Q. Too far with reference to the illuminating power? A. Not merely that. It may be carried so far as to remove all the free ammonia, and, in that case, the gas has not present in it a trace of ammonia to combine with the sulphurous acid formed by the combustion of the sulphur compounds with the production of sulphite and sulphate of ammonia in place of sulphurous acid.

Q. When and where have you seen green vitriol used in connection with the milk of lime you refer to? A. I should like to suggest a modification of your question, because I did not state that it was connected with green vitriol, for that would be preposterous. I said the two things are used in succession.

Q. You did not mean to state that you have ever known green vitriol to be used in connection with milk of lime? A. Not in the same vessel. This process is in use in Boston, and has been there used, to my knowledge, for twenty-five years. Since I had the pleasure of meeting you last, I have had an interview with Mr. Greenough, President of the Boston Gas-Works, who informs me that they still employ the wet-lime process, which process involves, as an essential feature, the partial use of green vitriol—in a distinct vessel, of course. The same process is in use in Providence.

Q. The iron process? A. No, sir.

Q. The wet lime and green vitriol? A. Yes, sir.

Q. Is not that an iron process? A. No, sir, not in the sense that gas-engineers use it. In the one case you will use sesquioxide of iron, and in the other proto-oxide of iron. In the one case you remove the ammonia, in the other not.

Q. Then the gas-works in Boston and Providence do use a different process from that employed by the Metropolitan Gas Company? A. Yes, sir; I so stated in my direct testimony; I believe there are other works in New England that do the same, but those are the only ones I have a personal knowledge of.

Q. Where is the wet-lime process now used in the United States? A. The places I have just mentioned, I say of my own knowledge.

Q. What is the difference between Laming's process and the iron-ore process employed in Europe? A. In Laming's process there was a mixture of lime and sulphate of iron, with a view to the removal of the ammonia and carbonic acid. The iron-ore process, as it is employed on the Continent of Europe, I have never seen personally, but, as I understand from those who have, it involves the use of the ore of iron—limonite—crushed and reduced to a proper state of powder, and mingled with some inert substance like saw-dust, spent tan bark, or some other inert substance.

Q. Can you state how Laming's mixture is made? A. I have never witnessed the preparation of Laming's mixture.

Q. What are the processes generally used in Great Britain or on the Continent? A. I think I have already stated in the direct examination that, in London and on the Continent of Europe, the usual process employed is the iron process; that is a point admitted fully, I think.

Q. Why has this process been employed instead of the lime process formerly in use? A. Chiefly from municipal regulations.

Q. What other reasons influence its employment? A. I think the cause which has been most influential, perhaps, with the companies, has been the consideration of economy, on their part. The restrictions in Great Britain, particularly with regard to the illuminating power, had been so very low, admitting the use of twelve or thirteen candle gas, that it did not signify if there was a certain quantity of carbonic acid left in the gas, inasmuch as I have already explained, in a former answer, the cost of the iron process is chiefly in the purchasing and maintenance of the stock, which is but very slowly exhausted and reduced, and is mainly due to the item of manual labor in the manipulation. There is an obvious economy on the part of the companies in their general expenses of administration, in the use of the iron process. They have not to purchase, daily, new quantities of lime, nor to haul away the refuse. It is objected with great force, by Mr. Clegg and others, to the use of the iron process, that its ventilation by the system known as Palmer's system is impracticable, because of the destruction of the apparatus, incidental to the high heat produced by the oxidation of the iron, which is sufficient even to raise the mass to redness.

Q. That objection would apply only to wooden apparatus? A. Yes, sir; I can conceive so; if the temperature rises to redness, it would undoubtedly endanger the purifying-boxes, and would agglutinate the material so as to require some more mechanical treatment than the shovelling to reduce it to a condition fit for use.

Q. Has not the question of offensiveness influenced the change from the lime process to the iron process? A. Unquestionably; that has been undoubtedly the principal or efficient cause that has induced legislation on the part of Parliament and municipal regulations, the offensiveness of the lime process. It is offensive—that is what we are all ready to admit.

Q. In your reference to municipal regulations, what may we understand you to mean? A. I understand that in Europe the police or local magistracy may present a gas company as a nuisance, if they judge, in their opinion, that the case is worthy of it; and that is what I mean by municipal regulations, as it is distinct from the general Metropolitan Gas Act, or Parliamentary Act under which the general administration of gas companies is placed.

Q. You would recognize, then, three distinct processes in present use—the dry lime, Laming's, and the iron process? A. I recognize four.

Q. The wet lime also, I suppose? A. The dry lime, wet lime, Laming's process, and the iron process. There are essentially two, however—the lime process and the iron process. The others are modifications.

Q. You stated as an objection to the dry-lime process, that the accumulation of the effete waste product about the gas-works, as ordinarily conducted, constitutes a just ground of complaint as a nuisance. Do you mean to limit this term nuisance to offensiveness of smell? A. I do; and I mean also to limit that remark to the lime which is of comparatively recent origin, because in the accumulations about a gas-works, where large masses of effete lime are piled up, it is only a comparatively small portion which is offensive. The same effect takes place in a few weeks by the natural process of atmospheric oxidation which, by ventilation, may be made to take place in two or three hours.

Q. Why, in large gas-works, would not this effete lime be exposed every few hours? The ventilators are opened about once a day, as I understand, in the winter season? A. I do not know that I understand what you mean by ventilators.

Q. The purifying-boxes, I should say? A. The purifying-boxes are opened at least once in twenty-four hours, ordinarily, once in twenty-four to forty hours; but, when the purifying-boxes are opened for the purpose of ventilation, there is no offence, because the act of ventilation commences instantly with the opening, and a current of air is then drawn inward to the products, so as to conduct them toward the other lime-box where the offensive gases are secured.

Q. As a general rule, does not the introduction of any foreign element into the common atmosphere tend to taint and deteriorate it? A. That is a general question, is it?

Q. Yes, sir. A. Certainly.

Q. Will you state, in the order of their predominance, the constituents of the foul gas-lime? A. I don't know that I should be able to do so with accuracy from memory, as it is a pretty complex mixture; but I would mention the sulphide of calcium, and the sulphide of ammonium, and the carbonate of lime, and the unexhausted hydrate of lime. Various compounds containing cyanogen, naphthaline, sulphuretted hydrocarbons, gas-tar, probably phenol, or other analogous compounds, carbonic disulphide. This last product is commonly esteemed one of constant presence in the effete products of gas distillation, but, I have reason to believe that it is not so commonly present as is supposed, from my own experiments. This is a general statement of what I conceive to be the important constituents present in the effete lime, prior to oxidation, while the box is yet closed, before atmospheric oxidation sets in. This effects important atmospheric transformations not here considered.

Q. This carbonic disulphide is identical with bisulphide of carbon? A. Yes, sir.

Q. What gases are evolved from this mixture when exposed to the action of the air? A. The first effect of access of atmospheric air to this mixture is that of oxidation, accompanied by a considerable elevation of the temperature, and the transformation of the previously-existing compounds into new states.

Q. Watery vapor is exhaled in considerable quantity, carrying with it sulphide of ammonium and free ammonia vapor of naphthaline and the vapors of various other hydrocarbons? A. I have answered this question in my direct examination, perhaps with sufficient fullness; I called attention in my direct examination to the important fact as touching the question at issue in this suit, that the vapors or exhalations, or gases if you please, which are given off from the effete lime, vary in the different stages of the progress of the oxidation or transformation; that the first and overpowering impression which is made, in the incipiency of this act of oxidation, is that of ammoniacal vapors, whether free ammonia or sulphide of ammonium, completely abasing and overpowering all other impressions; that the naphthaline odor is also easily recognized, but that the peculiar disgusting, heavy, persistent odors, which give to the gas-lime its abominable smell, do not make their appearance until a later stage of the process; and that these odors are often more distinctly perceived at a little distance from the works—I would rather say at a considerable distance from the works—than near at hand, while on the other hand the ammoniacal odors, and the other odors connected with the ammonia, disappear at no very considerable distance; in evidence of this I called the attention of the Board, at the last interview, to some test-paper which which had been exposed to the action of the atmosphere in the yard of the Metropolitan Gas-Works, showing that the radius, measuring from the purifying-house, upon which perceptible effects of sulphur vapors could be detected, did not exceed one hundred feet when the wind was blowing strongly in the direction of the paper from the purifying-houses.

Q. Which, if any, of these gases are poisonous? A. What do you mean by poisonous? Oxygen is poisonous.

Q. In the broad sense; not necessarily fatal to human life, but poisonous in tendency. A. There is no gas which, taken alone, may not in the strict sense be esteemed a poison. An animal will die if immersed in pure oxygen, and quickly, if immersed in pure nitrogen, by suffocation, yet the two gases together constitute the beneficial atmosphere in which we live. An animal will die if immersed in ammonia vapor, or in vapor of water, or in carbonic acid, either by direct suffocation or by specific poisonous influence. If by your question you intend to imply that either of the gases given off by the effete lime is exhaled in quantities sufficient to act as a poison, I take exception to the theory implied by the question. Sulphide of ammonium is undoubtedly a poison, in that a small quantity of it comparatively will de stroy life. The same is true of ammonia; the same is preëminently true of carbonic oxide. But these substances are often all present in the atmosphere, even of the purifying-house, in relatively very small proportions, and I appeal to the universal experience of the dry-lime process of purification everywhere within my knowledge and reading, for the absence of any evidence tending to show that any poisonous influence is exercised by these gases upon the health of persons frequenting those places and the places most exposed to them. I have yet to learn of the first instance of personal suffering, except in the single case mentioned last week, of the irritation of the eyes where persons were exposed to ammoniacal vapor, and that was entirely transitory.

Q. When exposed to the air, what becomes of ammonia? A. Free ammonia will speedily combine with carbonic acid in the atmosphere. Free carbonate of ammonia dissolves in the watery vapor of the atmosphere, and is diffused and lost—lost to the senses, I mean—nothing is lost in a chemical sense.

Q. What gas will be liberated by the action of the carbonic acid of the air on the sulphide of calcium, after the ammonia has escaped? A. I conceive, in the first place, that the carbonic acid of the atmosphere plays a very insignificant part in these chemical transformations. It is present only in four or five parts in 10,000 in the atmosphere. Undoubtedly the transformation which you ask about would result in the decomposition of the sulphide of calcium, with the formation of calcic carbonate, and the evolution of hydric sulphide.

Q. To what agent do you attribute the coloring of the lead test-paper you exposed to the air outside of the purifying-house? A. Sulphide of ammonium. I do not conceive it possible that hydric sulphide as such should exist in an atmosphere abounding in free ammonia. The two substances will combine to form ammonic sulphide.

Q. You regard Knapp's Technology as good authority? A. Up to the time of its publication, the publication in 1855, the second edition.

Q. In vol. i., part 2d, of the London edition of 1855, at page 610, he remarks as follows: "The mechanical retention of the ammonia is one of the chief causes of the intolerable stench which gas-lime evolves when exposed to the air. Sulphuret of calcium evolves sulphuretted hydrogen slowly when decomposed by the carbonic acid of the atmosphere; but, if ammonia be not present, part is composed of hyposulphite, which has no smell. In the latter case, however, carbonic acid is rapidly absorbed by the ammonia, and the neutral decomposition then ensues between the sulphuret of calcium and carbonate of ammonia, producing carbonate of lime and sulphide of ammonium, which escapes with its characteristic odor. So great is the nuisance produced by the effluvia from gas-lime, that numerous plans have been at different times suggested for its prevention." Do you agree with his views as there expressed? A. The passage in question rests, as I conceive, upon a false hypothesis, viz., that it is the carbonic acid of the atmosphere which is the efficient and primary cause of the decomposition and chemical transformation of the effete lime. I cannot conceive that this theory is consistent with facts. The immediate and rapid elevation of the temperature, which is perceived upon the exposure of the mass to the atmosphere, is to be accounted for, as I conceive, by no other hypothesis than that which is connected with the action of the atmospheric oxygen. It is an assertion which does not correspond with my own observation and long familiarity with gas-yards, that the peculiarly offensive smell of the gas-lime is chiefly connected with the evolution of the ammoniacal products. I assume that the salts present in the mass, which are chiefly active in the primary oxidation and the evolution of ammonia, are the sulphide of ammonium and the sulphide of calcium, which may, if you please, be considered as united in a double sulphuretted salt. It is perfectly rational chemistry to assume that these salts react with a given number of atoms of atmospheric oxygen, with the evolution of free ammonia and the production of sulphite of lime, for example, or hyposulphite of lime, both of which are inoffensive substances. I differ with great diffidence and hesitation from so high an authority as Knapp's Technology, but it is a matter of chemical opinion, and one chemist has as much right to his opinion in such matters as another.

Q. Do you regard Samuel Clegg as a competent gas authority? A. I do. He is one of the standard authors. The chemistry of Clegg's book is attributed to Dr. Frankland, who is certainly one of the best chemical authorities in gas matters.

Q. In his work on the manufacture of coal-gas, fifth London edition, at page 187, he says: "Foul lime as it is removed from the purifier consists of an admixture of several salts. Those only that need to be practically considered are the carbonate and hydro-sulphate of lime and the hydro-sulphate of ammonia, which constitute an important part of the total bulk. The analysis of these principal compounds shows that more than one-half the mass consists of carbonate of lime, nearly one-quarter of hydro-sulphate of lime, about one-fifth is hydrate of lime unacted on, and the residue contains the cyanogen salts and the silicious and other impurities of the limestone with the variable proportion of hydro-sulphate of ammonia retained in the mass mechanically. With such a mixture it is not surprising that the offensive odor is emitted on exposure to the atmosphere; for, in the first place, the hydro-sulphate of ammonia must pass into the air by a simple process of diffusion, while the hydro-sulphate of lime, being acted on by the carbonic acid of the atmosphere, will give rise to the formation of carbonate of lime, and a copious evolution of sulphuretted hydrogen gas. It is to the prevention of this evolution of sulphuretted hydrogen that the process of purification by oxide of iron owes its chief recommendation; for the affinity of oxide of iron for sulphuretted hydrogen is greater than for carbonic acid. Hence the sulphuret of iron, when removed from the purifiers and exposed to the air, emits no odor; while the sulphuret of lime is readily decomposed, and produces an abominable smell." To what extent, if any, do you differ from those views? A. I am perfectly familiar with the passage which is quoted. Have often read it. Some of its positions I accept, but in answer to the question would refer to the answer which has just been submitted to the next previous question. Inasmuch as I take a fundamentally different view of the nature of the chemical transformations, I consider the transformations due to atmospheric oxidation, and not to carbonic acid, and may be wrong in that opinion, but, having embraced and entertained that opinion, after mature consideration, I shall adhere to it until driven from it by experimental testimony. I have no partiality for one theory or hypothesis in this matter more than another, but seek to adopt that explanation of facts which is most rational and consists best with all the phenomena concerned. I don't mean to be understood as excluding by any means the action of carbonic acid in such action, but I do not consider it the primary and leading action; on the contrary, as already repeatedly expressed, that the action has its origin in the atmospheric oxygen. In support of this opinion I would submit the following chemical equations:

$N.H^4S+$	CaS	$+O^4=$	$NH^3,HO+$	CaO,S^2O^2
Sulphide of ammonium.	Sulphide of calcium.	Oxygen.	Ammonia.	Hyposulphite of lime.
NH^4S+	CaS	$+O^7=$	$NH^3,HO+$	$2(CaO,SO^2)$
Sulphide of ammonium.	Sulph. of calc.	Oxygen.	Ammonia.	Sulphite of lime.

Q. Subject to these modifications, you assent to his views—do you not? A. Why, no, I consider the two views irreconcilable—they are fundamentally different—totally different hypotheses: one commences with carbonic acid, and the other commences with atmospheric oxygen and carbonic acid; in other words, you have not the same factors, and you cannot have the same products; and, therefore, the two views are irreconcilable.

Q. In Dingler, vol. cxxv., page 159, taken from Dr. Ure, in speaking of the general malaria of London in 1850, in reference to the injurious influence of the gas-lime on the health of the people, he says that, "in building up a part of London named Pimlico, gas-lime was used for filling up the swampy ground. During the month of October, 1849, five men descended into the sewer in Kenilworth Street, for repairing, where they suddenly died. The corpses had a bronze-blue color, especially on the mouth, neck, and heart. The sewer itself was 418 feet long, 4 feet high, and 2½ feet wide, and was constructed out of bricks. The southern end of this canal was shut up, on account of only three houses standing there; but the northern end communicated with other sewers. There could only be drain-waters entering the canal, as no other but those three houses had a communication with it. On the bottom of this sewer was found, on investigation, a greenish earthy material one foot in depth, covered with a similarly-colored stinking fluid. A similar mass was found outside on the top of the canal. There was, therefore, no doubt but poisonous gases were generated from the gas-lime. Ure, and several other chemists, analyzed the solid as well as the fluid contents of this canal, with the following results:

"The solid mass was recognized as gas-lime saturated by hydro-sulphuric acid, sulphide of ammonium, and cyanogen compounds. In contact with the carbonic acid of the atmospheric air, those obnoxious gases were liberated and absorbed by the rain-water. This explains why the above-mentioned green-colored stinking fluid could contain those poisonous gases.

"From one of the London gas-works spent lime was taken and washed out with water; the fluid was then analyzed. One gallon of it contained 1,911 grains soluble matter, viz., 1,330 grains lime, 301 grains ammonia, and 280 grains sulphur. One gallon treated with hydrochloric acid generated nearly three (3) gallons of dangerous gases, and 3½ gallons of this fluid yielded 1 ounce of Prussian blue, which represents 25 ounces of hydrocyanic acid of the strength required by the London Pharmacopœia, a quantity sufficient to kill fifty persons. By this one may judge how detrimental to the health of the neighborhood the accumulation of gas-lime must be." Do you consider the authority good? A. Ure is a good authority; I should infer from the reading of this evidence that these men had been killed by exhalations which undoubtedly had their origin in the gas-lime under these exceptional conditions, and which contained hydrocyanic acid or prussic acid. The evidence, as far as stated, corresponds with that mode of poisoning. I would remark in this connection that the sulphocyanide of ammonium is a well-recognized product of gas distillation; that it exists in all gas, probably; the illuminating gas I mean, as it is distributed to the houses; and it is the opinion of good gas chemists that it is the chief source of the sulphur which escapes in the combustion of the gas which has been otherwise purified from free sulphur. In this connection I would also say that the most thoroughly purified illuminating gas, it matters not by what method it may have been purified, is itself, in the sense which is here employed, a poison. An atmosphere containing a considerable portion of free illuminating gas would be destructive of health, and numerous cases are on record of life destroyed by persons who, having retired, have carelessly blown out their light instead of extinguishing it, and though the atmosphere could not, in the course of time intervening between the night and the morning, have contained more than ten per cent., at the outside, of its volume of these gases. The offensive odor which illuminating gas retains is to be regarded as a blessing and not as a curse, that it is the one sufficient warning to instruct an unscientific and incautious person of the existence of danger. The suffocation of men who have descended into sewers or gas-wells is a fact of abundant record. Numerous instances have occurred in this country, some within my own personal knowledge, of men engaged in gas-works, descending into what is called the gas-well to look after the attachments leading to the main distribution, having been suffocated and lost their lives, not in consequence of any specific poisonous property that attaches to the illuminating gas as such, but that they were drowned in the irrespirable gases. They are irrespirable in the sense that they are insufficient of themselves, or even in the presence of atmospheric air, to sustain life, acting by exclusion of the atmospheric oxygen, and this is wholly irrespective of the question as to whether there may or may not be in the carburetted hydrogen gases portions of other substances, which are specifically poisonous in the sense that term is used by toxicologists.

Q. In the same sense, are not the gases evolved from spent lime when exposed to the air irrespirable? A. They are clearly.

Q. In your opinion, is sulphuretted hydrogen decomposed in the air? A. Yes, sir; decomposed or recombined. I would say, it may be decomposed or recombined with other substances in the air. Sulphuretted hydrogen, or compounds of that gas with ammonia, are always present in in the atmosphere of cities. A fact familiar to every housekeeper is that silver is speedily blackened by exposure to the atmosphere of our houses in towns, which is attributable to the presence of sulphur compounds in the atmosphere.

Q. Do you regard Berzelius as a standard authority on the subject of gases? A. I do.

Q. In the fifth edition of his work, vol. i., page 849, Berzelius says that sulphuretted hydrogen is not decomposed by dry oxygen? A. I did not say it was; I did not make any any such assertion as that. You asked me if sulphuretted hydrogen might not be decomposed in the air. I said yes; but the atmosphere is not dry oxygen.

Q. How do you suppose sulphuretted hydrogen to decompose in the air? A. There are various transformations of sulphuretted hydrogen in the air; it may be combined directly with ammonia or the carbonate of ammonia, both of which are liable to be present in the atmosphere from natural causes, in which case it would exist as sulphide of ammonium. In the presence of watery vapor it may be transformed by oxidation. I wish to add to that another point, which is a fact familiar to every chemist, that the solution of sulphuretted hydrogen in water cannot be kept for any length of time, because of the transformation or decomposition of that compound, accompanied by the precipitation of free sulphur, due to the combination of the hydrogen of the sulphur compound with the free oxygen dissolved in the water. The same transformation of sulphohydric acid occurs in the atmosphere, and from the same cause, viz., the oxidation of its hydrogen in moist air.

Q. Is there much watery vapor in the atmosphere during the cold season? A. The atmosphere is never without watery vapor.

Q. Is there as much? A. There is less during the dry, cold weather than during moist, warm weather, of course.

Q. Berzelius states, in the same volume, same page, that a single cubic inch of sulphuretted hydrogen is sufficient to make its presence apparent in all parts of a room by its disagreeable odor. Do you doubt this? A. Is the size of the room mentioned?

Q. In the case of a large room? A. Terms are comparative. If by a large room he means a room of this size, I say yes; but, if he means the Academy of Music, I say no.

Q. This sulphuretted hydrogen withstands decomposition for a certain length of time in the air? A. Yes, sir; it is wafted upon the winds a certain distance from sulphur springs, but not to a very great distance. I spoke of those springs near Rome, and in the neighborhood of Avon and Sharon.

Q. Same vol., page 852, Berzelius says: "Thenard, referring to the poisonous character of sulphuretted hydrogen, remarks that a bird died in air containing 1-1500th part of its volume of sulphuretted hydrogen, and a dog in air containing 1-800th part." Do you agree with the statement? A. Yes, sir; I do not admit the presence of free sulphuretted hydrogen in atmosphere containing ammonia. That is a point of difference between my friend Dr. Chandler and myself.

Q. Your statement as to the offensiveness of effete lime exposed to the air would apply to the process as conducted by the Metropolitan Gas-Works, would it not? A. It would.

Q. Are you aware of any special precautions being employed at those works, to prevent the spent lime from becoming a nuisance or offensive? A. Beyond the exercise of a reasonable vigilance and cleanliness about their purifying-house—in this respect I find the works in commendable order—I found no special precautions.

Q. There are none of the special precautions to which you refer? A. No, sir; there are not.

Q. Could not the Metropolitan Gas Company, with very little trouble or expense, abate or effectually prevent this nuisance in the way described by you, or by some other method? A. The offence complained of in the case of the Metropolitan Company may certainly be abated at no very large expenditure of time or money; it will take some time, and take some money, and without new causes of offence, or new causes of unhealthiness. Certainly I should like to add to that answer, that, in my judgment, they are entitled to a reasonable consideration in the time requisite for the effecting of such changes; they, of course, involve new constructions, and some expense.

Q. Is from the 15th of July last, to the present time, a reasonable time to make the changes? A. If the changes in question had been contemplated in July, they certainly could have been effected by this time; my familiarity with the case, however, dates from the 5th of February, I think. If they had entered upon such a process of reconstruction in July, they should have had it in efficient action long ere this; I cannot say, however, of my own knowledge, that, in the interim, they have not taken some precautions—that is more than I know.

Q. As an expert, you would recommend improvement in the ventilating process now employed there—would you not? A. They have none.

Q. Would you recommend the introduction of the ventilating process? A. I should recommend the introduction of a well-considered plan of ventilation, as the only efficient and sufficient cure for the evils complained of.

Q. You have recently visited the works? A. I have.

Q. Have you seen there any preparations for the introduction of such an improvement? A. Not to my knowledge; my attention was not called to any such; the remark was made that they were about moving certain masses of coal and buildings, with a view to new constructions.

Q. For what object? A. I did not inquire; it appears that the company have four extra purifiers—had at the commencement of this year.

Q. Could they not adopt the iron process in a much less period of time than that required for the ventilating improvement you mention? A. They have two sets of four boxes each at the present time, two of the older and two of the newer form of construction. There is not room in their existing houses for the iron process. There is not sufficient space, as I conceive, for the display of the mass of effete iron for reoxidation. It requires a very considerably enlarged area over the ordinary lime process to spread out the mass of spent iron, and revivify it. And that space does not exist in the present buildings. I should think the time consumed in suitable preparations for the iron process would not vary much from that which would be required for ventilation. I said I thought three months ought to do it.

Q. Could they not introduce the oxide of iron there, as it should be used to purify the gas. Could they not in a very short time? A. As I understand your question, it would contemplate the use of successive doses of iron material, as they now use successive doses of lime material.

Q. Could they not arrange to do that in a very short space of time? A. I think that that of course would be met with almost unsurmountable difficulties, for this reason, that the iron process does not work so well in the first action as in the second, third, and fourth. It improves to a certain point in quality, and, therefore, you would always be at the worst point if you were always to renew it.

Q. Suppose they had proper facilities for revivification, would there be any difficulty in introducing the iron process at once? A. None occur to me.

Q. What is the difficulty of using the space which they now occupy for their refuse lime for the purpose of revivification of their iron? A. I am not sufficiently familiar with the economy of the works exactly to say what the proper answer to that inquiry is.

Q. Is any peculiar machinery or buildings, or any thing of that kind, needed for revivification? A. Nothing but a shelter.

Q. A shed? A. Yes, sir; you want a somewhat steady temperature. That is, you would not wish it exposed to the outer air.

Q. I believe nothing has been said of the kind of lime used by yourself. A. In America we always use oyster-shell lime.

Q. What is the advantage of oyster-shell lime? A. It is an exceedingly fine form of lime. Its subdivisions or laminations render it peculiarly favorable.

Q. Is there any necessity of that shell-lime being fresh? A. It must not have been carbonated; it must be fresh hydrate of lime. Practically it is used as fast as it is burned.

Q. Is not the oyster-shell lime used because it is cheaper? A. I don't think that is a primary consideration. No, it is not cheaper. For instance, in Portland it is not cheaper than stone-lime.

Q. Is it used in Portland? A. I can't say it is; but I say in a lime country you can get stone-lime cheaper.

Q. Where you can get stone-lime, do they use stone-lime or shell-lime? A. I think that question would be decided by the relative economy.

Q. Are there not a great many portions of the world where they cannot get shell-lime? A. In England they use stone-lime almost exclusively.

Q. In what period of time will one hundred feet of gas, in its consumption, pass through an ordinary burner? A. It depends upon the size of the burner.

Q. Fix the size of the burner and fix the time. A. In a burner using five cubic feet, of course it would be twenty hours.

Q. I want to know what is the ordinary burner used in the house, how much? A. Their name is legion, if you mean the volume of gas they consume.

Q. Yes, sir. A. The volume of gas consumed would average from four to five feet.

Q. Therefore, it would take twenty hours on an average to burn one hundred cubic feet of gas? A. Yes, sir.

Q. With fifty grains of sulphur in that one hundred cubic feet of gas, is it your opinion that there is any injury to health from that amount of sulphur, in that amount of gas consumed? A. I never said there was any injury to health. It is a nuisance. The combustion, in the house, of gas containing sulphur occasions irritation to the eyes.

Q. Is gas purified by dry lime ever free from naphthaline? A. I think that is dependent on the temperature at which gas is made, and the variety of the coal from which it is made. Gas that is made from poor coals is never free from naphthaline. As you approach the limits of the law in England, in the matter of elimination, you increase the risk of precipitating the naphthaline which is held in solution in ordinary gas in virtue of the presence of the richer illuminating hydrocarbons; hence, gas which is made from poor coal is always more likely to let fall its naphthaline, and to occasion trouble to the gas engineer and to consumers, from the obstruction of the pipes by this crystalline compound, especially in cold weather, than gas which is made from rich coals.

Q. As the business of manufacturing gas in this city is conducted, is not naphthaline present? A. I conceive that naphthaline is almost uniformly present in coal-gas, and that it is a very important constituent of coal-gas. It being a powerful illuminator, the objection to it being, as I stated, that, when from false views of economy, or other reasons, poor coal is employed, the naphthaline, which ought to be sustained in the gas in the permanent form, is precipitated, and the loss of the naphthaline is a loss to the consumer.

Q. Is there any sanitary objection to its presence? A. I don't think there is. It is rather an agreeable thing to me to smell naphthaline as a perfume.

Q. Is there probably more than a trace of phenol in gas as it reaches the purifier? A. I have never examined that question personally.

Q. What is your opinion? A. I certainly should not expect the presence of any large quantity of phenol in the gas, though there is reason to believe it may be there in a sensible quantity.

Q. What becomes of the greater part of the phenol produced by the decomposition of coal? A. It is found in the coal-tar, and associated also with the tarry portion of the lime, or other agents of purification, in the purifying-boxes. I brought to this room last week, but I am not certain that it was exhibited, a bottle containing lime richly charged with tar from one of the purifying-boxes from the Manhattan Company, in proof that the tar is condensed in the purifiers, and Dr. Bowditch says you can always obtain from the best purified gas in London a portion of tar by methods which he gives, and I add that, with the tar, there is a legitimate portion of phenol. Phenol is the creosote of coal-tar.

Q. What will become of the minute trace of phenol remaining in the gas after purification, after the gas is burned? A. I suppose it must be exhaled among the effete products of combustion. I suppose it goes to watery vapor.

Q. Is it not quite probable that it will be burned with the gas? A. It is certainly possible.

Q. Is it not a good illuminating agent? A. It is.

Q. Is it probable that any possible nuisance could result from its presence in ordinary practice? A. No.

Q. Have you any reason for believing the oxide of iron is less efficacious in removing the phenol than the dry lime? A. I have no experimental reason.

Q. Have you any other? A. I have an impression that the phenol would be more apt to rest with the lime than with the iron. Still, that is an impression not founded upon the result of any experiments, and I do not attach any value to it.

Q. Is there any chemical reason supporting such an impression? A. It is rather hard to analyze one's convictions on any thing of that sort. An impression rests in my mind upon the general knowledge of the subject. There is a compound of phenol with lime. I don't know that there is any with iron. There is just where the point of departure on the impression arises. Chemistry is an experimental science preëminently, and experiment does not always substantiate the theoretical exceptions of chemists; sometimes it does more.

Q. Is not this substance considered the best antiseptic found in gas manufactories? A. I so stated in my direct examination, and gave examples.

Q. And is it used in such practice? A. Yes, sir, in the practice of antiseptics, and in the preservation of meats, and so on.

Q. Is it not probable that the carcasses you mentioned in your direct testimony, as not likely to undergo decay in the purifying-houses, would be preserved by phenol, and not by sulphuretted hydrogen and not by sulphide of ammonium? A. I intended in that testimony to convey the distinct impression that it was the phenol that would act as the antiseptic generally, and never the sulphuretted hydrogen.

Q. Is there any thing in phenol or its properties which renders the question, whether more or less of it would pass by the lime or iron process, of any importance to this investigation? A. No, I think not.

Q. Then the introduction of the question of phenol you would leave out entirely? A. I think it is a very interesting question, but I don't think the public health is prejudiced in the least by it.

Q. Is the phenol given out to the atmosphere from the effete lime in any way so as to have a practicable or perceptible effect upon the atmosphere? A. The proper answer to that question would involve experimental data, of which I am not possessed.

Q You have no knowledge that it is given out? A. No personal knowledge.

Q. Have you any theoretical knowledge? A. I think that in the decomposition of the lime it would be given out.

Q. So as to have any practicable or perceptible effect on the atmosphere? A. I revert to my testimony in regard to the effect upon carcasses.

Adjourned to Thursday, the 18th instant, at one o'clock.

THURSDAY, *February* 18, 1869.

Prof. Benjamin Silliman, recalled. Cross-examination resumed.

Q. Is not acetylene burned or destroyed in the combustion of the gas? A. Not always; on the contrary, acetylene is produced in the combustion of gas, if that combustion is in any considerable degree impaired. For example, in the ordinary wire-gauze gas-stoves, which are so frequently used in warming small apartments and in cooking, acetylene is produced in very notable quantities, as has been proved long since by Berthelot; and there is reason to believe that acetylene is also produced under other conditions than those of the wire-gauze gas-stove; when the supply of oxygen is imperfect, or from any reason, as from the presence of carbonic acid; perhaps it may be from an insufficient supply of oxygen gas. This fact has been very lately brought to our notice afresh by a recent Memoir of Berthelot, which is published in the proceedings of the "Paris Chemical Society." The title is now changed to the "*Bulletin de la Société Chimique.*"

Q. As gas is ordinarily consumed, is acetylene produced in any considerable quantity? A. The question is answered in a reply to your previous question. Berthelot, in the last memoir above referred to, affirms that, in the ordinary bat's-wing burner as ordinarily used, acetylene may be detected. I have not verified this statement myself, but Berthelot is such an excellent authority that I would not question his accuracy.

Q. In Dingler, vol. clxv., p. 149, Berthelot states that gas contains but a few ten-thousandths of acetylene. Do you agree with that statement? A. How recent a number of Dingler is that?

Q. 1862. This is a copy of Berthelot's original article. A. I accept whatever statement Berthelot makes, as an authority.

Q. Do you regard its removal from gas a matter of any importance in the quantity in which it generally exists? A. I regard its presence in gas as very undesirable, and that whatever tends to its production should be carefully avoided, for I believe it is fully in proof that the presence of small quantities of acetylene in the atmosphere where gas is burned, and resulting either from the distribution or combustion of gas, is proved to be particularly prejudicial to health and comfort, and that it induces headache and sickness, and *malaise*, which is complained of by those who inhabit rooms which are warmed by unventilated gas-stoves. It is one efficient cause of *malaise*.

Q. Do you regard it as any more injurious than the smell which arises from the burning of kerosene? A. I am not aware that the smell which arises from the burning of kerosene is injurious. It is disagreeable and offensive. I never experienced any ill effect from these odors. Nobody of choice disseminates ill odors of any kind in apartments.

Q. Have you any good reason for supposing acetylene to be any more injurious than the odor just spoken of? A. Yes, sir. I think that is clearly in proof that it is not merely an ill odor, but a poison acting on the nervous system. I do not know that any one asserts that the odor from burning petroleum is a poison.

Q. Your objection applies more particularly to cases where gas is applied to stoves? A. The production of acetylene under those circumstances is far more notable—more abundant.

Q. Does it not appear in gas purified by lime as well as by iron? A. I dare say it does; I have detected it in gas purified by lime.

Q. Have you not detected it in gas purified by iron? A. I never have. I have never had the opportunity; I have never seen that process in operation, except at the New York Gas-Works, and under circumstances not favorable to experiments. I simply consider it the duty of gas companies to render gas as free as possible from every source of objection that can properly be raised against it as an article of consumption in houses. It is unquestionable that in the United States we consume gas in our domestic life far more commonly than is done in England. It is still a comparatively rare circumstance in England that gas is used in houses, and the prejudice against it in London when I was there, which was several years ago, was very strong, and chiefly, as I believe, because they had been so ill-treated by the metropolitan companies.

Q. Do you mean to state that the dry-lime process is the only one which removes carbonic acid from the gas? A. No; the wet-lime process removes carbonic acid very perfectly, and the Laming process may remove carbonic acid also, perfectly, if it is properly conducted; but I conceive that no iron process which is entirely without the presence of lime will purify gas completely of carbonic acid.

Q. Would not Laming's iron process as applied in London effectually remove the carbonic acid? A. I judge from my readings only, for I have never had an opportunity of observing it personally, that Laming's process is capable, when properly conducted, of depriving the gas of its carbonic acid, but that, in fact, as ordinarily conducted, it does not.

Q. I limited it to the London application. A. I speak of it exclusively as applied in London. My inference is founded upon my readings of the discussions of that subject in the English journals. I know that the complaint is general, in London, of the low quality of the gas as respects illuminating power, and that the statement is constantly reiterated that the gas does contain a notable portion of carbonic acid. It is true that the Metropolis Gas Act requires only 14-candle power, which we should consider very low.

Q. You stated that the oxide of iron of the New York works evolved ammonia; where did it get this? A. I do not recollect what I stated in my direct testimony; of course the ammonia must come from the gas.

Q. The oxide of iron does, then, absorb the ammonia from the gas? A. It does.

Q. Is there any affinity between lime and ammonia? A. There is; there is a double compound of lime and ammonia—the carbonate of lime and ammonia, a salt distinctly recognized. At the same time, every chemist understands perfectly that the action of quick-lime is to decompose ammoniacal salts and set ammonia at liberty, and it is for that express purpose that quick-lime and sal-ammoniac are employed for the evolution of ammonia. In the ordinary dry-lime purification, the ammonia is of course in the largest measure removed by the water of the hydraulic main and the water of the scrubbers, and but a small portion of the whole product finds its way into the purifying-boxes, and that chiefly as a sulphide of ammonium. I believe I have already explained that method of decomposition sufficiently—the ammonia and the effete lime.

Q. Has not iron a positive and well-recognized affinity for ammonia? A. It has—the hydrous sesquioxide of iron, which is a common iron-ore, is well known to absorb and retain it with obstinacy, and this property it possesses in common with ordinary clay, and it is to this joint effect that Liebig and other agricultural writers attribute the peculiar value and efficiency of clay in soils for the retention of ammoniacal salts.

Q. Has not iron a stronger affinity for ammonia than lime? A. Certainly.

Q. In your direct examination, in stating the advantages of the lime process over the iron process, you gave as a reason that the lime more effectually removed the sulphur, carbonic acid, and ammonia; what reason had you for embracing ammonia? A. The ammonia is not removed in the lime process as ammonia. It is not in that form that it occurs in the lime purifying-boxes. It exists there solely as sulphuret of ammonium or ammonic sulphide, and it is from the decomposition of this salt, under the conditions which I have already described, that the powerful ammoniacal odor arises which is exhaled when the atmosphere commences its action upon the effete lime. I think I remarked in the same connection, as as far as I can now recall my testimony, that I did not regard the presence of a small proportion—say not exceeding four or five grains of that substance in one hundred cubic feet of gas—as in any degree prejudicial to the consumer; but, on the contrary, that I thought its presence to a moderate extent—not exceeding that amount—desirable, and that it was even desirable that there should be so much present that it would react upon turmeric paper, for the important reason that the presence of ammonia under these conditions secures the sulphur in a harmless form, since in the combustion of the sulphur the whole of that product appears as sulphurous acid. If ammonia is also present at the same instant, the two substances unite in the form of sulphite of ammonia, a salt which is white and harmless, and may be often seen condensed upon the under side of the metallic belts that are hung above the chimney of an argand burner. The coating which lines the chimney, when it is moist and freshly made, and which may be seen afterward, when dry, as a frosty-looking deposit, is the salt of ammonia produced in the manner which I have indicated; and hence I regard the presence of the small trace of ammonia which is usually found in gas as rather beneficial than otherwise. The allegation, that it produces nitric acid or nitrous acid in its combustion, appears to me to be of doubtful application; at all events, I have never seen the evidence of the presence of nitric acid under these circumstances.

Q. Then you do not regard its presence in gas as an objection to the iron process? A. Not at all—no, not to the extent specified. It is, of course, quite possible for the gas manufacturer to send his gas to the consumer so imperfectly purified of ammonia that its presence shall become a nuisance. It is then altogether probable that nitric acid vapors will be produced in a noticeable quantity, and a peculiar greenish, non-luminous character given to the color of the flame. This may be recognized by the eye. I have often observed it, as every other careful observer must have done, in noticing gas in the act of combustion.

Q. That impurity would be more likely to exist in gas purified by lime than that purified by iron, would it not? A. I do not know that it would.

Q. Is it not true that the London gas purified by iron is claimed to be remarkably free from ammonia? A. The parliamentary act—the gas act—allows the presence of five grains of ammonia; and I observed in a recent discussion on that subject, which took place within the present month in London, that a distinguished gas engineer, Mr. Hawksley, speaks of the presence of ammonia as being easily recognized, by turmeric paper, in the London gas. I do not remember of what particular company he spoke. I have quoted Mr. Hawksley as the authority. It occurs to me since doing so that it might possibly have been one of the other gentlemen who were involved in that discussion, which took place on the occasion of Dr. Odling's lecture before the Board of Health. In the *Journal of Gas-Lighting*, published at London, July 7, 1868, page 524, Dr. Odling says: "The next constituent of coal-gas to which I shall call your attention is ammonia. The proportion of ammonia in London gas is very small. We find that one grain of ammonia in one hundred cubic feet of gas is sufficient to affect turmeric paper, upon which ordinary London gas is used, without, or almost without, action." Q. Would you regard Dr. Odling an authority upon that question? A. I have quoted him as such. I was going to quote him against himself. I have his lecture of the 2d of February, 1869, here.

Q. The gas referred to by him is purified by iron. Is it not the ordinary London gas he speaks of? A. He does not say so, but I presume such is the fact. With your permission I will read what Dr. Odling says in his lecture before the Metropolitan Association of Medical Officers of Health, published in the *London Journal of Gas-Lighting* for the 2d of February, 1869.

Q. What does it refer to? A. This question of ammonia.

Q. The presence of ammonia in gas? A. Yes, sir. It is in support of what he says before: "I suppose I must say that all coal-gas contains some ammonia—that is to say, it contains some, chemically speaking, so that, if it were required to recognize it, ammonia might be detected in any coal-gas whatsoever. The greater part of the coal-gas supplied in London, however, contains but a very small portion of ammonia. The act of Parliament requires that coal-gas shall be so free from ammonia as not to affect turmeric paper, and ordinarily the gas in London either does not or only just does affect turmeric paper. When we bear in mind the extreme delicacy of this test—I think that it has been calculated that one grain of ammonia in one hundred cubic feet of gas will affect the test-paper decidedly—you may infer that the ammonia in ordinary gas, where it does not or does only just affect the test-paper, is so small as to allow of its being disregarded. At the same time, where the ammonia does exist in any quantity, it is certainly objectionable. There is no doubt that by its combustion it produces a certain amount of nitric acid, which is prejudicial in many ways, and that the ammonia itself is prejudicial to the brass taps and fittings."

I believe that is the latest testimony we have on that subject. I would remark in that same connection, that I have lately determined the quantity of ammonia in gas, which I have been making, under a series of experiments, in connection with Prof. Wurtz, in New Haven, with the hydrocarbon process, and I have found that it amounts to but little more than half of one grain in one hundred cubic feet of gas, but that the gas which is furnished to the city of New Haven, being made by a different process, is considerably richer in ammonia, although still within the parliamentary restriction.

Q. How much richer? A. I cannot give you the figures until I calculate them: I have them in my pocket. I have not calculated the result.

Q. Does it color turmeric paper very distinctly? A. Very decidedly—very distinctly. The other does not; it does not affect the turmeric paper at all. It falls within the observation of Dr. Odling, that one grain of ammonia in one hundred cubic feet of gas will affect turmeric paper.

Q. Then it must contain more ammonia than the London gas? A. I think it probably does, but I am not prepared to say that as of authority, for I have not the exact figures.

Q. I believe you have already stated that the New Haven gas is purified by the dry-lime process? A. Always.

Q. In the fifth edition of Clegg's "Treatise on Coal Gas," published in New York in 1868, page 196, he states: "By none of the processes of purification we have described is bisulphide of carbon effectually removed; nor has any process yet been discovered by which gas can be purified on a large scale from this compound of sulphur. The Metropolitan Gas Companies have consequently been unable to comply with the conditions required by the Metropolis Gas Act of 1860, that the gas shall not contain more than twenty grains of sulphur in every one hundred cubic feet. The gas companies who supply the city of London applied to Mr. Barlow, in 1864, to ascertain whether it was practicable by any known process to abstract the sulphur compounds so as to attain the required standard of purity. Mr. Ellisen, the chemist of the experimental works of the Paris Gas Company, instituted numerous experiments with that object, but the conclusions they arrived at were not encouraging." Would you agree with Clegg in that statement? A. Not entirely, for reasons that I would state. My own experiments upon the presence of bisulphide of carbon or carbonic disulphide in coal-gas have not been such as to leave upon my mind the impression that this form of sulphur is of so frequent occurrence as is stated in nearly all literature on gas chemistry.

I have diligently sought for that product by the best accredited methods, in the case of the company of which I am the chemist, in New Haven, and in gas which I had especially made by experimental processes, from various sources, for myself, and I have not detected it. I do not mean to be understood to say that it does not occur, or occur frequently, in London gas; chemical testimony about that point is explicit; but I do mean to be understood as saying, that I do not regard it as by any means so frequent or of so universal occurrence as is stated. I believe at our last interview (as well as I recollect my testimony) that I made the statement which I now repeat, that there was, in my judgment, good reason to believe that the form in which sulphur more frequently exists than in any other in coal-gas, was that of sulphocyanide of ammonium—the combustion of course resulting in the production of sulphurous acid. I also stated, as I believe, in my direct testimony, that it was the current opinion of the best gas engineers who have written upon this subject, as far as I know, that the lime process is more effectual in removing the sulphur than the iron process; and the evidence, as produced in the discussion before the British Association of Gas Manufacturers, which was quoted on a former occasion, was adduced in support of that opinion; and that opinion I now reiterate, that it is not possible for the iron process so closely to remove the sulphur, as it is ordinarily conducted, I mean, as in the dry-lime process. If the dry-lime or other lime process is added as a supplement to or a portion of the iron process, then the sulphur will be as effectually removed in the one case as in the other.

Q. Dr. Letheby, in his quarterly report on the supply of gas in the city of London, given in the *London Journal of Gas-Lighting*, July 21, 1868, page 562, states that the average quantity of sulphur has not been excessive, though in 46 out of 160 cases the quantity of this impurity exceeded 20 grains per 100 cubic feet. The Great Central Company's gas averaged 14.54 grains, the Chartered Company's gas averaged 18.86, and the City Company's gas averaged 18.97 grains. Do you regard that statement as authoritative? A. Of course—it is official.

Q. Do you regard the proportion given in that statement as excessive. A. It falls as an average within the parliamentary act. In that sense it certainly is not excessive.

Q. The companies referred to in this statement do not use the dry-lime process, do they? A. I presume not. It is a point granted, that in London they use the iron process exclusively.

Q. Do you consider Prof. William Odling, Professor of Practical Chemistry at Guy's Hospital, and Secretary of the London Chemical Society, an authority upon practical chemistry? A. I have already had the pleasure of answering that question more than once, and I shall be happy to reiterate, as often as you repeat it.

Q. Have you read the following statement by that gentleman, on page 562 of the journal last cited, July 21, 1868? A. I presume I have. I read the article at the time of its appearance—the same being in his lecture to the British Association of Gas Managers:

"So far, then, I am a little at issue with gas managers in being disposed to admit, that ordinary coal-gas contains a geater amount of sulphur in some form or other than they are willing to allow, and than the letter, though not the spirit of the act of Parliament, permits; for the act was framed upon the results furnished by an incomplete combustion of the gas, and condensation of the products. But, on the other hand, I am altogether at issue with the public when they maintain that the sulphur of gas produces, by its combustion, oil of vitriol, or that the amount of sulphur ordinarily contained in gas is of any consequence whatever; and a little consideration will, I think, satisfy you of the soundness of this position. We will assume that coal-gas contains, not 20 but 40 grains of sulphur in 100 feet—a quantity at any rate greatly exceeding the reality. Now, making the extravagant assumption, that the whole of these 40 grains of sulphur would be completely burned—and in reality they would be burned very incompletely—they would furnish by this combustion 80 grains of sulphurous-acid gas. This quantity of the produced sulphurous acid would occupy, at ordinary temperature, about one-fifteenth part of a cubic foot, and since 100 cubic feet of our coal-gas gives one-fifteenth of a cubic foot of sulphurous acid, 1,500 cubic feet of our coal-gas would be required to furnish one cubic foot of the acid, even upon the extravagant assumption we have purposely made. But the combustion of 1,500 cubic feet of coal-gas would produce something besides sulphurous acid. It would produce, at least, 1,000 cubic feet of carbonic acid, and, in addition to its dilution by other gases and vapors, we should have our sulphurous acid diluted by 1,000 times its volume of carbonic acid. Now, if we can get at the proportion of carbonic acid in the atmosphere of a room highly illuminated with gas, and take the 1,000th part of that proportion, we shall be able to form some notion of the amount of sulphurous acid present. You will remember that the amount of carbonic acid furnished by the breath of one individual is equal to that furnished by two three-feet gas-burners, and that the maximum amount of carbonic acid found in the atmosphere of a crowded theatre was .32 per cent. Now, if, in addition to our previous unreasonable supposition, we further suppose that an atmosphere contains .2 per cent of carbonic acid furnished by gas combustion, you will see that the whole matter becomes a *reductio ad absurdum*—that we might actually have one half-millionth part of sulphurous acid present in the air of a gas-lighted room.

"But this sulphurous acid is not sulphuric acid, and can only be converted into sulphuric acid with very much pains and difficulty, as all who have tried the experiment of converting the sulphur of coal-gas into sulphuric acid are painfully aware. When gas is burned in special apparatus, indeed, its constituent sulphur can be converted into sulphuric acid; but it is very difficult to do this. The probability is, that of the sulphurous acid produced, in ordinary combustion, scarcely a particle gets converted into sulphuric acid—certainly not more than the ammonia ordinarily existing in the atmosphere can neutralize, so as to form sulphate of ammonia instead of sulphuric acid." A. Yes, sir; I am familiar with the statements alluded to.

Q. Is not sulphurous acid an excellent disinfectant? A. No. I do not know that I should rank sulphurous acid as a disinfectant. I recognize it as an excellent antiseptic. There may be some confusion of terms in this regard. I regard chlorine as an excellent disinfectant, but I do not propose to fumigate my parlor with it.

Q. In the pamphlet on the application of disinfectants on arresting the spread of the cattle plague, by William Crookes, F. R. S., at page 20, is the following statement, entitled "Sulphur Fumigation:"

"Of all disinfecting processes this is perhaps the oldest. Its action was well known in the days of Homer, for we read that Ulysses employed it to remove the smell of dead bodies. It is recorded by Ovid, that the shepherds of Italy yearly purified their flocks and herds with burning sulphur, and passages in other writers show that they averted diseases from them by this means."

Would you agree with that statement? A. I believe that sulphurous acid is a very powerful agent in destroying the germs and spores from which contagious and other diseases are propagated, and have so stated in my testimony already given.

Q. Is not an agent that removes infection, as you state, a disinfectant? A. I suppose it would ordinarily be so classed, still the terms are used with a good deal of vagueness. Sulphurous acid is a well-known specific agent for the cure of cutaneous diseases, a property which it enjoys in common with sulphur, from which it is produced, and for fumigation in hospitals, for which purpose it is of long standing and with satisfactory results.

Q. Are you confident that the smell you perceived near the ceiling in the room where gas was burning, as described in your direct examination, was sulphur? A. I did not say it was sulphur; I said it was the smell of sulphurous acid and sulphite of ammonia, producing the well-known choking effect which makes the stifling atmosphere observed in an ill-ventilated room in which numerous gas-lights are burning. I did not say it was sulphur—it is a very different thing.

Q. You stated that when the oxide of iron is ventilated in the purifiers it becomes heated and sets fire to the screens—is any difficulty of this kind experienced in the New York works? A. In the New York works the iron is not ventilated in that manner. It is ventilated upon the floor. They do not ventilate their iron in boxes—the case is entirely distinct.

Q. Then there is no necessity of ventilating the iron in the purifiers? A. Not unless you wish to prevent a stink.

Q. What stink did you refer to in your answer? A. That which is described as so noisome by some English authorities as exhaled from the effete iron.

Q. You never noticed that. A. I referred specially for authority to the description of the Rev. Dr. Bowditch.

Q. You did not notice that offensive smell in your visit to the New York Gas-Works? A. No. My recollections in regard to the visit in question are a little indistinct, as I have stated in my direct testimony. I remarked on that occasion, that I visited the works for the purpose of examining into the economic character of the process, rather than its sanitary character, and paid but little attention to the stench.

Q. You are not aware that the oxide of iron used in the gas-works at Copenhagen is daily ventilated in these boxes? A. I know nothing about the Copenhagen works.

Q. You stated that you visited the New York works last summer, among other things to ascertain the economic value of their process—what experiment did you then and there make? A. I made no experiments other than the ocular observation of the character of the gas which I noticed in the photometer room, or dark room, in which I found it burning.

Q. How did you know then that the gas produced at these works was not as pure as when purified by lime? A. I only inferred, from the investigation of the gas, that it was a gas of low quality, and that as such it undoubtedly contained a portion of carbonic acid to which its low illuminating power was attributed. It is well known that the presence of even a moderate quantity of carbonic acid very greatly depresses the illuminating power of gas.

Q. Could you detect the difference of one or two candles in the illuminating power of gas, without the aid of the photometer? A. Two candles very readily, unless the gas was of very high or low illuminating power; anywhere between the range of twelve and sixteen or twelve and eighteen candles, I could detect with my eye the difference of two-candle power readily. That is a matter of habit which grows upon one from constant use of the photometer, and daily personal observations with which I am familiar.

Q. In the German edition of Muspratt, vol. iii., at page 1522, is the following statement which I will ask Prof. Chandler to translate.

(Professor Chandler translated as follows:)

In speaking of the material used in purifying gas, Muspratt states that—

"Of all these materials, Laming's mixture and the iron-ore have obtained the most general or prominent introduction. Laming's mixture has, above all others, particularly lime, essential advantages. After being once used, it can be regenerated and used again. According to Unruh's experiment in Magdeburg, the purification from sulphuretted hydrogen takes place so completely that one cannot detect the smallest trace by the most delicate reagents, and the quantity of carbonic acid in the gas is extremely small—the illuminating power not less than when lime is employed; and the smell of the foul mass trifling."

Do you regard that as good authority? A. I do not know the author of the article in question—whether it is attributed to Dr. Muspratt or to the German editor, Kerl. I can only say that it is a difference of opinion between many authorities, and that this statement is at variance with the current literature of English gas engineers.

Q. From the same author and volume, page 1523, is the statement that Prof. Chandler will read, entitled "Purification with iron ore:"

"This ore is often cheaper or more easily obtained than Laming's mixture, and is regenerated at first slower and afterward more rapidly. At the new city gas-works in Berlin, the ore obtained in Upper Silesia is employed. In the gas-works at Hanover the fine pulverized ore of Lunenberg mixed with spent tan and refuse dye-wood is employed."

Do you regard that statement as authoritative? A. I regard it in the same light as the other statement by the same author. It is an illustration of the difference of opinion that competent authorities entertain with regard to the same method.

Q. Do you recognize "Wagner's Chemical Technology" as good authority? A. I do.

Q. At page 699 of that work it is stated that, "much more important than all the previous methods of purification and really establishing an era, is the process of R. Laming in 1847."

Q. Do you regard Bloxam as good authority? A. He is a good chemist.

Q. In his Chemistry, at page 450, referring to Laming's process, he says: "A great many other methods have been devised for the purification of gas from sulphuretted hydrogen, but none appear to be so efficacious and economical as that which consists in passing the gas over a mixture of sulphate of iron (green vitriol or copperas), slacked lime, and sawdust, which latter is employed to prevent the other materials from caking together. The lime decomposes the sulphate of iron, forming sulphate of lime and hydrated oxide of iron." Would you agree with that statement? A. So far as I know, the statement is correct. I mean, of course, in that answer that it is a correct statement of Laming's process, so far as I understand it. I do not necessarily give in my adhesion to the inference which he draws from it.

Q. In Wagner's "Year Book of Chemical Technology," vol. ix., page 713, it is stated in regard to the cheapness of the lime process. He simply states that the expense of purification is reduced to nothing by virtue of the value of the sulphur which is extracted from the foul oxide. Have you any reason to doubt that statement? A. I have no reason to doubt the statement, though I have never seen that statement confirmed elsewhere. It has often been mentioned, as an advantage of the iron process, that the sulphur could be extracted from it.

Q. In Bowditch's work on the use of coal-gas, London edition, 1867, at pages 19, 20, and 21, are the following statements:

"About this date the use of gas was increasing very rapidly" (that was in 1844, the date referred to), "the gas companies in London, and in some of the large towns, were sadly encumbered with and troubled about the lime-refuse which arose from purifying their gas. Purified, the gas must be. Sanitary regulations most properly prevent the running of blue Billy —wet-lime refuse—into streams and rivers, and in some cases prohibited the carting away, from gas-works, of dry-lime refuse during the daytime. Matters seemed to be approaching a crisis, when, in 1849, Mr. Hills came to the rescue and introduced hydrous sesquioxide of iron as a purifying agent instead of lime. * * *

"When a certain quantity of sulphur has been set free in a mass of oxide of iron it becomes useless—not because its chemical affinity for sulphuretted hydrogen is destroyed or even lessened, or because the ore has lost the power to restore it when it is foul, but because it is clogged with inert sulphur. Mr. Hills further showed that when thus useless as a purifying agent the oxide yet had a value, for the accumulated sulphur could be converted into sulphuric acid, and for this purpose the oxide was worth what it cost at first, and in some cases I believe even more. This was an enormous boon to urban gas companies. It delivered them from a great difficulty in reference to the foul lime, and taught them how to free their gas from sulphuretted hydrogen, without any cost for material to do so. * * *

"The use of lime after the oxide would remove the carbonic acid from gas, and need not produce any nuisance or involve more than a nominal cost, as the lime might be fit for use for the removal of carbonic acid over and over again. The evolution of the sickening vapors emitted by foul oxide need not be a serious annoyance, as the oxide can be revivified in the purifiers themselves, or in a building whence all effluvia can be carried through fires into the atmosphere, so as to be harmless." Do you agree with the statement read? A. I accept Mr. Bowditch's statement of the iron process as an exhibit of its claims, but I observe that he recognizes the noisome exhalations which the iron gives forth, and suggests a method for their removal which is essentially the same thing which has been recommended already for removing the similar nuisance from lime—a method of ventilation which was tried here in the Manhattan Company, and blew up the chimney which they built for the purpose, and destroyed considerable property.

Q. In the "Manual of Elementary Chemistry," by George Fownes, late Professor of Practical Chemistry in University College, London—the London edition of 1868, edited by H. Bence Jones, and Henry Watts—at page 180, he says: "The use of lime, however, has been almost superseded by that of a mixture of sawdust and iron oxide." Do you agree with that statement? A. I do. That is an historical statement of the condition of the art in Great Britain and Europe.

Q. Do you recognize Professor E. D. Mapother, M. D., as a good authority upon sanitary science? A. Yes.

Q. In his lecture upon public health, Dublin edition of 1867, at pages 53, 54, and 55, are the following statements: "In both the gas-works the mode of purification had been by the wet-lime process, and the resulting refuse was conveyed into open tanks for the purpose of allowing the undissolved lime to settle from it. This lime was afterward used as luting for the retorts, and the water is pumped under the furnaces, where it is consumed. At the open part of the sewers in Benson Street, which has been recently covered in, about thirty yards from where the boy was suffocated in July, 1864, this refuse-water might have been often seen. I believed that sulphuretted hydrogen escaped from the tanks while the refuse was exposed to the air, from the luting of the retorts, and from the water while being dried upon the furnace-pans, and I am convinced that such escape was most injurious to the health of the workmen and surrounding population. My opinion was painfully verified by the suffocation of three men by sulphuretted hydrogen, in a pit dug on the premises of the Alliance works, in September, 1865. The lime-refuse must have percolated from the tanks into the surrounding earth. Unwilling that so great, and in the beginning so expensive, a change should be urged upon the companies, without my opinion being supported by London and other authorities, I wrote to the Medical Officers of Health of nine English districts. All condemned the lime process, and approved of the iron process, except one eminent chemist, who stated that with proper precaution the wet-lime process need not be a nuisance, injurious to health. I also consulted several eminent gas engineers, and quoted authorities such as 'Muspratt's Chemistry,' 'Barlow's Chemistry of Gas-Lighting,' 'Hughes's Treatise on Gas-works,' and thus produced much evidence upon the noxious character of the wet-lime process in a populous town. In order to determine the matter by personal inquiry, the corporation commissioned me to examine the works in London and other English towns, during October, 1860, and I accordingly visited the London, City of London, Phœnix, Equitable Chartered, Imperial, York, and Scarboro works, and ascertained that in all the lime process had been found to produce nuisance, and that, therefore, the oxide-of-iron process had been substituted. * * * The only company which we now have has entered into a contract for the erection of purifying chambers by the iron process, during summer, when alone extensive changes can be made in gas-works, and they will be in action immediately."

Q. Do you accept these statements as authoritative? A. I understand these statements as applicable in the instances cited about the wet-lime process. I do not understand that the wet-lime process is on trial here. Nobody proposed to introduce that. It is not used in more than two or three companies in the United States, as I have before stated; and it is, where the blue Billy cannot be disposed of at once into the ocean, an unquestionable nuisance.

Q. Would not the fact, that the authorities spoken of by this author introduced the iron process in preference to the dry-lime process, go to show that they did not deem the dry-lime process as furnishing the remedies? A. They have been compelled by the municipal regulations to introduce the iron process into most of the towns of England. It is not from choice, but from necessity, as I understand, that this change has been effected in the majority of the cases.

Q. What authority have you for stating that the Metropolitan Company use Boghead coal in the manufacture of their gas? A. I saw the coal there, and obtained a portion of the coal there for my own use.

Q. Was not that temporarily used? A. I only mentioned Boghead as one of the enriching coals that they used.

Q. The inference might have been that they were in the habit of using "Boghead." A. They used, I said, either "Boghead," or "Wigan," or "Lesmahago," or some other well-accredited cannel-coal. All those I saw there and could speak of from my own knowledge. That is my authority—my own personal observation.

Q. Is your opinion, that the gases evolved from refuse lime employed in the purification of gas are harmless, based upon actual knowledge of the effect of these gases upon the blood? A. It is based upon an actual knowledge of the effect of these gases upon living men—human beings—in the vicinity of the gas-works, and through a long course of observation. I have never made any experiments as to the effect of the introduction of this gas into the arterial or venous system of man. I believe my opinion of that subject was fully expressed on the occasion of our last interview in answer to a question which the learned counsel addressed to me, in respect to Dr. Ure's testimony in regard to parties being suffocated in a pit.

Q. You spoke of them as being drowned in the gases? A. Yes, sir.

Q. How far from the gas may sulphide of ammonium be floated before it becomes so transformed as not to be perceptible to smell? A. No very considerable distance.

Q. It would vary, I suppose, with the varying conditions of the atmosphere? A. Compared with the distance to which the heavy and persistent odors of the hydrocarbons are floated, to which just objection is made on the score of offence.

Redirect examination by Judge Van Vorst:

Q. I would like to ask you whether the process called the Laming process is in use in the United States? A. Not to my knowledge. The only gas-works that to my knowledge certainly is employing an iron process is that one which has been so often mentioned in the city of New York, and they do not employ Laming's process, but a modification of the English or European iron process, in which, as already explained, a variety of bog-ore or sesquioxide of iron is mingled with a certain proportion of iron turnings, the whole mass drenched with ammonia-water, and mingled with charcoal and exposed to the atmosphere after oxidation, for the purpose of revivification.

Q. You know nothing about Laming's process except as you have read of it in gas literature? A. I have never had the opportunity to study Laming's process, and know it only by reading.

Q. Do you know by reading whether it is adopted in Europe to any extent? A. I believe it to be adopted to a considerable extent in some parts of Europe.

Q. In some parts of Europe, Professor Silliman, do you know any thing of what the advantages or disadvantages of it are, as compared with the dry-lime process. A. I believe I have already pretty fully stated my opinion upon that subject in the direct testimony, and also in the cross-examination.

Q. Now, with regard to the wet-lime process of which you have spoken—that you say is in use in Boston? A. In Boston, and in use in Providence.

Q. Do you know whether it is in use in any other part of the country? A. I do not know it to be in use elsewhere than in those two places.

Q. In your opinion the fouled lime, unless it may be removed by being cast into the ocean at once, is a decided nuisance? A. It is a very decided cause of offence.

Q. How would it compare with the dry lime in that respect? A. In that regard, it is more offensive than dry lime. It does not present the same opportunity for removal. This fouled lime must be removed in close vessels of some kind, or, if suffered to remain in sewers, or in streams, it would become a very just cause of offence.

Q. You stated that the ventilation of the oxide of iron in the boxes destroyed the boxes? A. That is a statement which has been very frequently quoted in my direct testimony.

Q. If it could be ventilated in the boxes, the noisome odors of which you have spoken might be avoided? A. Undoubtedly, if a system of ventilation could be adopted, which would prevent the too high temperature, I see no objections.

Q. You say there had been an experiment, as you understood—something toward ventilating it in the boxes—tried by the Manhattan Company with regard to the lime? A. Yes, in the case of lime.

Q. Did they not attempt to ventilate the lime there in the boxes? A. The case to which I alluded is this: They attempted to adopt substantially what is known as the Palmer process of ventilation, which consisted in expelling the air which had been drawn through from the boxes, carrying with it the offensive odors into the bottom of the stack or chimney provided for that purpose, with the expectation of burning it in that stack; but the result was an explosion, resulting from the mingling of the gas and the atmospheric air, which destroyed the stack, and blew the engineer out of the window and damaged property to a considerable extent.

Q. And, subsequently to that, they have made additional improvements? A. They have adopted an entirely different method of ventilation, which has already been explained in the previous testimony.

Q. Now, do you know whether that method of ventilation of the fouled lime adopted by the Manhattan Company, of which you have spoken in terms of commendation, prevails anywhere else in the United States or in Europe? A. I am not aware that has been adopted anywhere else in the mode it has been adopted there.

Q. Do you regard that, then, on the part of the Manhattan Company as an experiment? A. I regarded it as a successful experiment.

Q. But as an experiment nevertheless? A. It is an experiment of their own introduction. I do not regard it as an experiment, if that implies a doubt of its success.

Q. Would you regard that as an improvement? A. Yes, sir.

Q. Do you know whether it is or is not the subject of a patent? A. I do not know any thing about it.

Q. How late is it that that method of ventilation of the fouled lime in the Manhattan Company has been communicated to the public, to your knowledge? A. It has been well understood among gas engineers and persons interested in gas purification for more than a year that the Manhattan Company had achieved a success in that direction.

Q. But the details of it were not known? A. I think not. So far as I know about this, there has been no detailed description of the method or its operation, as of authority.

Q. It has not made its way into the literature of the art, as far as you know? It has not entered into the gas literature of the day? A. It is not to be found, as far as I know, in any of the gas literature of the day; I think the description, which we have given in this discussion here, was the first which came before the public in a formal manner.

Q. When did you see it first yourself? A. I first saw it some time during last summer, perhaps it might have been in June.

Q. Then you first visited the works—first became acquainted with the fact that they had this method? A. I have been in the habit of visiting the Manhattan Works for a great many years, but I visited them for a knowledge of the new system of ventilation last summer; and more recently I have visited them again.

Q. At that time it was regarded by them as a success? A. Yes, sir. The engineer spoke of it to me as being an experiment at the time.

Q. But subsequent experience has proved it to be measurably successful? A. Yes, sir. They are so well satisfied with it, that one of the officers told me last week, they contemplate the coming season to erect new sheds to cover the necessary revivifying boxes.

Q. They produce much more gas in the Manhattan Company than they do in the Metropolitan Company? A. I think four or five times as much.

Q. And use four or five times as much lime for purification? A. Yes, sir.

Q. Whatever there is offensive about the manufacture of gas—if there is any thing offensive about effete lime—it would be magnified at the Manhattan Works? A. Yes, sir. My recollection is that they consume one bushel of lime to every 3,600 or 3,700 cubic feet of gas, and that the daily make of gas is 5,000,000 cubic feet.

Q. The oxide of iron at the New York Works was, you say, on the floor. A. Yes.

Q. It was not ventilated in the boxes? A. No, sir.

Q. And whatever was objectionable in regard to its emanations and exhalations went into the atmosphere? A. Of course.

Q. Of whatever character? A. Yes, sir.

Q. As you went there for the purpose of regarding the process in its economical bearing, you were not sufficiently informed as to that? A. No, sir.

Q. You have been inquired of by Colonel Hastings, as to the article of William Odling, Professor of Chemistry at Guy's Hospital, and the article has been put into your hands for examination. Now, sir, will you please to state in what regard, if any, you differ from Prof. Odling in regard to that method? A. Dr. Odling has rehearsed with great detail the whole matter of the chemistry connected with the combustion of gas in houses, on the occasion of the recent meeting of the Metropolitan Association of Medical Officers of Health.

Q. How recent, professor? A. At a meeting of the Board of Health held in Fleet Street, London, in January of this year, as I understand.

Q. Subsequent to the article (to which your attention has been called) of his, July, 1868? A. That article was the substance of an address which he gave before the British Association of Gas Engineers. This is substantially the same as the former lecture, but is somewhat more in detail, as it is in print, particularly the consideration of questions connected with the consumption of gas in houses relative to domestic use. With his customary clearness and exactness of statement, Dr. Odling, in this very interesting communication, which extends over five columns of the *Gas-Light Journal*, goes minutely into the consideration of all the important questions raised by the subject of discussion, and, among others, he rehearses what has been before quoted with respect to the amount of sulphur which is contained in gas; and, following this communication is a discussion of the points of the lecture, in which Dr. Letheby, Mr. Hawksley, Mr. Findlay, and others, took part. Dr. Letheby, whose name is even more intimately associated with the subject of gas chemistry than is that of Dr. Odling, and who is the gentleman to whom we are indebted for some of our most important methods of analysis in gas chemistry, takes exception to the remarks of Dr. Odling, in respect to the importance of the sulphur product resulting from the combustion of gas, meaning thereby, of course, the products of sulphurous and sulphuric acids, which are evolved in its combustion. With your permission, I will submit a few of Dr. Letheby's remarks in detail. In the *Journal of Gas-Lighting*, London, February 2, 1869, page 83, he says: "And now, I am desirous of making a few remarks on the effects of sulphur in coal-gas. Dr. Odling has directed your attention to this matter from a statistical point of view, and has shown you how, by a mathematical process, the amount of sulphur-acids in the products of burning gas may be reduced to a vanishing point, and that, therefore, they must be insignificant and wholly harmless; but I will ask you to look at the subject from another point of view, and to examine it in the light of facts as well as of figures. About fifteen or twenty years ago, when I began to inquire into this matter, I was struck with a circumstance which is now, as it was then, very remarkable—namely, that, wherever gas is burned continuously, and in large quantity, it causes a rapid destruction of textile fabrics, with a very acid condition of them. This is notably so in our public libraries, and in ware houses and shops. I obtained so many striking proofs of this, especially from the libraries of the Athenæum Club-house, the London Institution, the College of Surgeons, and elsewhere, that I made them the subject of a special report to the city authorities in 1854, and here you will see the specimens of covers of books which were furnished to me at that time. If you apply a piece of the leather to your tongue, you will taste its acidity, and if it be treated with water or spirit of wine, and tested with a solution of baryta, it will be found that the acid is sulphuric acid. These effects were observed many years ago, in the library of the Athenæum Club-house, and they were growing to be so serious that the managers requested a commission of chemists, including Dr. Prout, Mr. Aiken, and others, to inquire into it, and I have before me a copy of their report on the subject. It is to the effect that the mischief is clearly due to the presence of sulphuric acid, which had come from the burning gas; and they state that the mischief will continue as long as gas is used in the library without proper ventilation. Mr. Faraday thereupon designed the system of ventilation, which is still used in the library. As to the effects of the products of burning gas on shop-goods, they are notorious, for such goods are regularly disposed of as damaged or gassy things. It has been remarked, too, that plants are quickly killed by the products of burning gas, for they are peculiarly susceptible of injury from the presence of sulphurous acid in the air; according to Drs. Christison and Farmer, as little as one part in 10,000 of air will kill plants in less than twenty-four hours. And you cannot use gas in a conservatory, either for heating or for illuminating purposes, unless the products of combustion are entirely removed. Dr. Christison has written to me very strongly on this subject; and he attributed the absence of flowers and plants from the rooms of Edinburgh to the circumstance that gas is universally used in them. Advancing a step further in my inquiries, I ascertained that the water produced by burning gas, collect it how you will, is always acid, and will rot leather, paper, cotton, and linen. Here are specimens of such tissues, which have been dipped in the condensed liquid products of gas combustion, and you will observe that they are as rotten as tinder. Lastly, I contrived a plan whereby the amount of sulphur in coal-gas could be estimated. I had thought that the instrument was sufficiently well known, and the *rationale* of its action thoroughly understood; but the instrument, which Dr. Odling has placed upon the table, and has described to you as my ingenious contrivance, is so different in all its essential particulars from my own instrument, that I disown it, and call it an ingenious perversion of the apparatus which bears my name. I know from experience that such an instrument will not discover half the sulphur that is really present in coal-gas; and I have no doubt that the discrepancies, which have lately been referred to by writers on this subject, have been occasioned by the use of such an instrument as is now upon the table. The particulars of my instrument, the measurements of the several parts of it, and the mode of using it, are fully described in Mr. Sugg's book on gas manipulation, and, if it be used in a proper manner, it will discover all the sulphur of the gas; and thus it will be found that the amount of sulphur may reach to from thirty to forty grains per one hundred cubic feet of gas. If the presence of sulphur in such quantity in coal-gas was an unavoidable necessity, and could not be reduced by any reasonable process of manufacture or purification, it would be folly to complain of it, other than to show the necessity for good ventilation where gas is burned; but this is not the case, for there are processes of purification which will easily diminish the amount of sulphur to less than half the usual quantity. Mr. Hawksley, whose presence this evening will, I hope, be useful to us, by his giving us the result of his large experience in this matter, has shown that, by copiously washing raw gas with ammoniacal liquor, it is possible to remove a large proportion of the sulphur compounds of gas without injuring in the slightest degree its illuminating power. After this treatment the gas should be deprived of its sulphuretted hydrogen by means of hydrated oxide of iron, and then, while a little ammonia is still remaining in it, it should be further purified by passing it through dry lime, which is the slightly moistened hydrate of lime. In this way the ammoniacal liquor is strengthened to a high degree—it being rarely less than of 10 oz. strength—by the absorption of ammonia compounds, and by the removal of sulphur in other forms than that of sulphuretted hydrogen. The hydrated oxide of iron is also less foul than it usually is, and is capable of revivification, without annoyance; while the hydrate of lime is actually inoffensive, for it contains nothing but carbonic acid, sulphocyanogen, and sulphur, produced by the reaction of ammonia on bisulphide of carbon in the presence of caustic lime. Mr. Hawksley will tell you, what I also know from experience, that by these means the amount of sulphur in coal-gas is easily and certainly reduced to about 10 or 12 grains per 100 cubic feet of gas. It is easy, as I have said, to meet this question by a numerical argument, and to show by a mathematical process of reasoning that the amount of sulphur in gas may be made to vanish almost entirely; but I would rather examine the practical or experimental facts, and endeavor to remedy what is among practical men an acknowledged evil, by applying those remedies which are clearly within our reach."

In that connection I desire to present to your notice a quantity of sulphur by actual weight, such as the English law allows, viz., 20 grains of sulphur to each 100 cubic feet of gas.

[A weighed portion of 20 grains of sulphur was here offered in evidence, and package marked "Exhibit B."]

You will observe that it is by no means an insignificant quantity regarded as a material substance. I may say that, if that quantity of sulphur were suddenly burned in an atmosphere no larger than that in an ordinary sitting-room, the air of the room would be insupportable. But it is worthy to be remembered that that quantity of sulphur is actually set at liberty in the form of sulphurous acid in about five hours' time in an evening, in a room which is lit by four ordinary gas-burners of the capacity of five feet each, and that it is in evidence from Dr. Letheby and others, that the gas may even contain 30 or 40 grains in every 100 cubic feet. It is always to be remembered that the largest product in bulk, which is given off in the burning of gas, is water, in the form of watery vapor; and that this watery vapor takes up and absolutely retains sulphurous acid, and rests upon the windows, upon the paint, and upon the hangings, if there are any; and upon the books and bindings that are in the room, and that in the upper portions of the room it is especially noticeable, owing to the temperature, resulting from the combustion and the warmth of the room, that these products are most abundant.

In this connection Mr. Hawksley remarked, in the discussion before alluded to, that—

"He was enabled to state that, by the use of ammoniacal liquors for the purpose of washing the gas, and by the use of lime in the process of purification, the sulphur could be reduced, without any sensible depreciation in illuminating power, to as little as ten grains in one hundred feet, that was to say to as little as one half the quantity which was allowed by the act of Parliament. Now, it might be said that this was not worthy the attention of professional men in that room. It was said, and said with some truth, that the gas companies had been driven away from the use of a very valuable agent by persons who complained that the use of lime in the purification of gas was a nuisance. They had consequently been driven to employ the oxide of iron, which was a very imperfect agent for the removal of some of the compounds; and the general result was that, in order to free our streets from the occasional smell of foul lime, we put sulphur into our dwelling-houses. He did not think it was any improvement in a social sense at all, and it was always desirable to ascertain whether, in effecting changes which might be proposed, and which might appear to be beneficial, we were not producing injurious effects in another direction. However, such had been the results. He did not think, with regard to the question of the presence of ammonia, that any notice whatever, in the present state of the manufacture of gas, need be taken of that agent. The quantity was so small, even in the gas which was the worst purified, in the sense of the removal of ammonia, that he did not believe any effect at all—any appreciable effect—detrimental or otherwise, would arise, and he would say this with regard to the alleged effect of gas upon books and furniture, and other articles of that sort, that, although he believed there had been a considerable effect produced when gas was very much more purified than it was at the present day, yet he believed there were now other causes operating to produce the effect, which were at least as great as gas, if not greater. The quantity of coal consumed in London gave off more than 6,000 tons of sulphur into the atmosphere every year, and so large a quantity as that must in itself produce a very sensible effect; in point of fact, we know it. But, besides that, we must not forget the influence of temperature. With a large quantity of gas burned in a room, near the ceiling, unless special means of ventilation were adopted, the temperature would be very high indeed—so high that it would be impossible to exist in it for many minutes, perhaps not for one. Well, now, that had a very serious effect upon books and furniture, and he attributed very much of the rottenness of books—always greater on the higher shelves than on the lower—to that cause. He believed gas had been very largely discredited in consequence of other influences, which did not proceed from the combustion of gas itself." * * * *

"Mr. Findlay said he had been connected with two of the largest gas companies in London for sixteen or seventeen years, and he quite agreed with the remarks of Mr. Hawksley about the use of lime. It was a question whether they ought not to go back to the old practice. It was well known that there was no better process of purification than by means of wet lime, or dry lime; it must always be a nuisance to a certain extent."

By *Mr. Van Vorst:*

I don't know whether it was taken down or not, but I understood you to say in your cross-examination, that gas in London was not consumed in the dwelling-houses to any thing like the extent that it is consumed in the dwelling-houses in this country. A. That was the case when I was familiar with London; and it is not to this day, as I am assured, esteemed fashionable to hold a ball, or reception, or entertainment, in the evening with gas The houses are lit then with wax-candles, and there is still a prejudice in London, to a great extent, against the use of gas in houses, to a much greater extent than is known in this country.

Q. Is there any thing more you wish to say? A. I think the subject has received sufficient ventilation without trespassing on the time of the honorable referee any further.

By *Mr. Hastings:*

Q. Is not the quantity of sulphur left in the gas after purification very largely caused by the kind of coal employed in the manufacture of the gas? A. Not necessarily. The amount of sulphur compounds produced is directly as the amount of sulphur in the coal, but the amount of sulphur left in the gas depends largely on the method of purification. If the gas is improperly purified, of course the amount of sulphur it contains will be greatly increased. The difficulties and the cost of purification, and the time which is consumed in the act of purification, are all greatly increased by employing a coal which, in the technical language of the coal-house, is dirty. Dirty gas is likely to be the consequence. There are many coals which, but for the large amount of sulphur they contain, would be very desirable indeed as gas-coals, but they are inadmissible, from the reason referred to. This remark is true of most Nova Scotia coals, some of which will yield as high as four and a half cubic feet of gas of excellent illuminating power, but, by reason of the large amount of sulphur which the coal contains, it is found not economical or profitable to employ it. I beg leave in this connection, as you have brought the subject up, to call your attention to an important paragraph in Clegg, which Dr. Chandler will at once remember. On page 197, he states in a single instance that "one of the anomalous results obtained in the experiment"—alluding to experiment made by Mr. Palmer and Mr. Ellison, which you have already quoted—"that the quantity of sulphur present in the coal does not bear any proportion to the sulphur compounds in the gas produced from it."

Q. Other things being equal, would not a coal, containing twenty per cent. of sulphur, yield a gas containing more sulphur products than that produced from a coal containing only ten per cent.? A. I conceive that the answer to that inquiry is properly conveyed in my former answer. The quantity of sulphur products would of course be in proportion to the amount of sulphur contained in the coal, but that which would remain in the gas would not be necessarily greater. In this paragraph which I have just quoted is a single sentence perfectly in point: "Thus it appears that the gas obtained from the Denain coal, from the neighborhood of Valenciennes, which contains 31.10 pounds of sulphur in one ton, gave a maximum of 7.48 grains of sulphur per 100 cubic feet, while the gas from Stavely coal, containing 26 pounds of sulphur in one ton, yielded 22 grains of sulphur to 100 cubic feet of gas." It appears, therefore, in answer to your question, that there is no direct ratio between the amount of sulphur contained in the coal and that which will be found in the gas—that the coal which contains a less proportion of sulphur as an original constituent, than another coal, may yield a gas which contains less sulphur by constitution than the gas produced from another coal containing a larger amount of sulphur.

Adjourned to Saturday, February 20th, at one o'clock.

TESTIMONY OF PROF. HENRY WURTZ.

SATURDAY, *February* 20, 1869.

Prof. Henry Wurtz, called and sworn on behalf of the Metropolitan Gas-Light Company; examined by Judge Van Vorst:

Q. Where is your residence? A. My residence is in New Jersey; my business in New York City.

Q. What is your vocation and profession? A. I claim to be a chemist; call myself a scientific and practical chemical expert.

Q. How long have you studied the subject of chemistry? A. About twenty years, sir, more or less.

Q. With what institutions have you been connected in the practice of your profession as a chemist? A. I was at one time in Yale College, as assistant to Prof. Silliman, in what was called the Scientific School at that time, at Yale College; I was Professor of Chemistry in the National Medical College at Washington; Professor of Chemistry in the college at Kingston, Canada; Chemical Examiner in the United States Patent Office, where the subject of gas came before me practically.

Q. Have you given particular attention to the subject of the manufacture of coal-gas? A. I have, sir.

Q. Have you studied the subject of its purification? A. I have, sir.

Q. Have you observed the subject of purification practically? A. Within the last year I have spent a considerable amount of time on various occasions in examining processes of purification on the ground, if that is to be understood as studying it practically.

Q. Are you familiar with the lime process of purification—dry lime. A. I am, sir.

Q. And with the method of purification by the oxide of iron? A. Yes, sir, so far as a gas chemist can become familiar with it in this country, I presume: the only place that I am aware of where it is used being the works of the New York Gas-Light Company in this city, which I visited on two occasions when they were using the process, and had permission to examine into the minutiæ of its workings.

Q. The dry-lime process of purification is that which is in use in the United States, is it not, sir? A. So far as I am aware, with the exception of two or three gas-works, in which the wet-lime process is used.

Q. One is in Boston, is it not? A. One is at Boston, and one, I think, at Providence; but the last account I received from the Providence Works they were proposing to substitute the dry lime.

Q. When was that? A. Quite recently—within a fortnight—I heard the fact; I have no special knowledge, however, in the matter.

Q. I would like to ask you what are the results of your observations of the lime and iron processes for the purification of gas; you may speak of it in a scientific point of view and also in a sanitary point of view. A. With regard to the scientific points involved, sir, I would remark that I believe the ground has been so thoroughly gone over by Prof. Silliman, that I should have little to add, and the more especially so as a great portion of the same ground has already been gone over by me in print, and, therefore, I would propose to present a copy of a report made by me to the Manhattan Gas-Light Company during the last summer, made in manuscript, and which they printed about the first of December, or the latter part of November last, and of which I have some printed copies here.

Q. Will you produce a printed copy of that? A. I have several here.

(Prof. Wurtz produced a printed copy of the report, which was offered in evidence.)

Q. In that report do you discuss the claims of the two systems of purification—the lime and the oxide of iron? A. I do, sir; I would remark, with regard to this report, that in this report there is brought forward some account, intelligible at least to gas chemists, of the new process which has been spoken of here previously by experts.

Q. At this hearing? A. Which has been spoken of previously by other experts, not at this hearing, but a previous hearing—the process of the Manhattan Gas-Light Company—there is, however, no specification given of this process, as I understand the meaning of the term specification, in a technical and practical sense; in fact, such specification was purposely omitted by me. I did not feel authorized or called upon to present such a specification.

Q. Specification of what? A. This method of purification; such a specification as would render it possible for a gas engineer to put it into practice.

Q. Do you mean of the Manhattan Company's process—of ventilating the effete lime? A. Yes, sir; the question may be of the ventilation of effete lime; nevertheless, the principle of the process could be understood by gas chemists, and I should mention that this pamphlet has quite recently—within six weeks—been republished, or copied by the London *Journal of Gas-Lighting*, and has, consequently, actually become a part of the current literature of gas.

Q. When was this report of yours published? A. So far as my memory serves, it must have been about the 20th of November, 1868, that it was printed; it was circulated though, I believe, only in a private way.

Q. Have you any reason to alter your opinion now, as expressed in this report made by you? A. The only essential addition that I would suggest is to add to the substances which are extracted largely by hydrate of lime from the gas, the constituent called naphthaline, which is not extracted to so large an extent by oxide of iron. Allow me to read one of the paragraphs from this pamphlet.

Q. Which page is that? A. On page nine; I present, in the form of some conclusions, in one paragraph, this one: "It thus appears that of those constituents of crude coal-gas, which may be viewed as contaminations, and whose separation is desirable, there are no less than four of the most objectionable, which, while distinctly under the control of the lime process, cannot be shown to be separable by any recognized or reliable chemical or other agency residing in oxide of iron; these four are carbonic acid, ammonia, bisulphide of carbon, and phenol;" and to these I would now venture to add naphthaline.

Q. These four contaminations, then, you say, are distinctly under the control of the lime process, and are eliminated by it; is that so? A. The results of the examination appear to show that. I would also add: I find in my notes that I mention the nitrogenous and sulphuretted odorous matters of the gas which are complained of.

Q. What do you say about those? A. I have no reason to suppose that the oxide of iron retains these in any form, although they are largely retained by hydrate of lime.

Q. Well, then, I suppose you mean the oxide of iron is a very imperfect purifier; a low purifier with regard to the carbonic acid, ammonia, bisulphide of carbon—phenol, and naphthaline, you would add? A. Naphthaline, and at least a portion of these specially odorous compounds which form the subject of complaint by the public.

Q. You adopt the pamphlet now, then, as a part of your testimony in this case, and offer it as such? A. Substantially.

Q. Have you said all that you designed to say about it, in a scientific point of view, or is there any thing further to be added in that respect? If not, then you may proceed to state the result of your observations from the sanitary point of view? A. I would add the following remark: In the present condition of the subject, a fundamental consideration for the gas chemist is, that before any final decision as to the adoption of a method in a large gas-works, on the smooth workings of which so much depends, a precise chemical solution should be arrived at of all the questions and problems involved. This would take time. Realizing this, I have recommended it to the gas companies, and especially to the Manhattan Gas-Light Company; and I might add that the chemist of the Board of Health, Prof. Chandler, was invited to join in this investigation. This investigation has not yet, however, made much progress. Other matters have intervened.

Q. What is the state of that investigation now? A. I regard all these proceedings *here* as a portion of that investigaton; and an essential portion, an important portion, a valuable portion, and a fortunate portion of that very investigation.

Q. What results will proceed from it, in your judgment? A. The ultimate results, I doubt not, if it is carried on in a right spirit, and with diligence, will be the removal—the entire suppression of all the unpleasant consequences resulting usually from the impurities in the purification of the gas, and the improvement of the quality of the gas at the same time.

Q. Will you speak of the result of your observations of the lime and iron processes for the purification of gas from a sanitary point of view? What are the advantages or objections to each process? A. First, I would prefer to make one or two general remarks: It is understood by myself, and, I believe, by the public generally, that formal and deliberate accusations have been brought against the Metropolitan Gas-Light Company, to the effect that they have been guilty of negligence affecting the health and the life of portions, at least, of the community. I regard these accusations as pure fantasy, while, at the same time, I would not deny the existence of a bad odor by any means. That would be absurd—quite as absurd in the opposite direction; neither would I deny the necessity of exercising all due diligence and exhausting science in preventing the escape of this bad odor—a subject which is occupying the attention, I may say, of gas chemists all the world over at the present time, but which is by no means satisfactorily solved, unless we may regard the process so very recently developed by the Manhattan Gas-Light Company as a solution. I may say that I individually do regard that as a solution, and so stated in the pamphlet referred to; and the other gentleman brought forward as an expert concurs, it would appear from his testimony, fully with me in this. I would add, that I have never met with any evidence pointing toward the truth of this accusation of any deleterious or detrimental action upon health, or any injury to health, or danger to health, arising from the emanations from gas lime under ordinary circumstances. I have remarked that I consider this a fortunate investigation. I consider it fortunate to the Metropolitan Gas-Light Company, because it gives them an opportunity to purge themselves from these accusations of having injured the public health and endangered life. These accusations, if true, would really amount to accusations of a criminal negligence. I might add, that the experts who have testified in the case have already been attacked, by implication, in the newspapers, for aiding the Metropolitan Gas-Light Company, and that is one reason why I make these deliberate remarks. Now, with regard to the sanitary bearings, I will take the several substances in order: First, carbonic acid. The view has been presented in the course of this investigation, that a small proportion of carbonic acid in the gas is of no importance in a sanitary point of view. I would say, in my opinion, as an expert, this remains to be proved, and that the probability is that any thing which impairs the rapid and complete combustion of the gas in a confined room is extremely likely to be injurious to the health of the occupants of the room. To ammonia the same remark applies as to this; but, at the same time, I do not regard it as of any very great importance. Prof. Silliman has already suggested an important beneficial action which ammonia exerts, when left in the gas, in neutralizing to a certain extent the products of the combustion of sulphur, which always remains in the gas in a greater or less quantity—of sulphide of ammonium. This is the most important constituent which we have to deal with, doubtless, in a sanitary point of view. Both the lime and the iron processes, doubtless, extract these completely from the gas when properly applied. The very fact that the oxide-of-iron process extracts it at all is a sufficient answer in the mind of chemists to the allegation that has been made that there is free sulphuretted hydrogen in the gas. It is difficult to understand how oxide of iron could absorb sulphuretted hydrogen—free sulphuretted hydrogen from the gas, except in the presence of an excess of ammonia, and then it becomes not free sulphuretted hydrogen, but sulphide of ammonium. The consideration of the sulphide of ammonium, then, is narrowed down to its effects in the material used for purification, and its after-effects upon the atmosphere. In the case of oxide-of-iron purification, the effete iron, when taken out of the purifier, is believed to contain a large quantity of sulphide of iron, It may contain some ammonia. As Prof. Silliman has already stated, it is well known that hydrated oxide of iron does absorb ammonia to a certain extent, though not by virtue of any definite chemical affinity that has ever been pointed out. As I understand it, just as clay, dust, or any finely-divided material, as, however, all the sulphide of ammonium is converted by the oxide of iron into sulphide of iron and free ammonia, and chemists would expect that some of the ammonia set free would travel on from the iron purifiers with the gas. I am not aware, however, that the chemical points involved in these considerations have been worked out satisfactorily. I am drawing inferences from theoretical considerations in a great measure. When the effete oxide of iron is exposed to the air, then we have a mass of sulphide of iron, which immediately attracts oxygen from the air, producing heat and burning. There is a danger here, which seems inherent in the process; that the heat may become so high as to set fire to the mass of sulphur, and sulphurous acid would be produced by the combustion of the sulphur. This danger probably increases in proportion as the mass has been revivified and reëmployed. It is alluded to in some of the works upon the subject, as a difficulty now undergoing investigation, and being probably gradually mastered. I have here a work, recently published by Zerah Colburn, on the gas-works of London, in which he states, on page 50: "Sulphuret of iron precipitates its sulphur on exposure to the air, and again combines with oxygen, occasionally with such energy as to take fire." On page 55: "The precipitation of sulphur and the resumption of oxygen are occasionally so rapid, especially when the material has been used a few times, that it smothers and actually enters upon active inflammation." In the latter case the sulphur vapor is almost overpowering. On page 57: "At the Commercial Works, however, Mr. Jones has his apparatus in readiness, and may have already commenced, indeed, to revivify Hill's oxide in his purifiers." The date of this is 1868.

Q. The author, then, is speaking of the method of purification by oxide of iron, is he not in this instance? A. Yes, sir, in London. This is a practical work very recently published, and the impression gathered by a gas chemist is, that the subject of the revivification of oxide of iron is not yet reduced to such a certainty as to avoid with certainty this difficulty of catching fire of the great quantities of free sulphur which are thrown out of these purifiers and the consequent diffusion of great quantities of sulphurous acid throughout the neighborhood of the gas-works. In the case of the lime purifier the sulphide of ammonium is largely absorbed as such, and appears to form a compound with lime, or with sulphide of calcium, as yet not investigated or understood by chemists. On exposure to the air this material undergoes oxidation also, the main substance given off being free ammonia, which carries with it, however, some sulphide of ammonium. I have heard no evidence yet brought forward, and I have met with no evidence in all my readings, of any deleterious effects from sulphide of ammonium. I have here a sample of sulphide of ammonium. Any gentleman can test the effect of it upon his nose and lungs by actual experiment. Here is a very concentrated solution of sulphide of ammonium, containing, as it almost always does, when it has been standing some time, free sulphur in solution, indicated by the yellow color, and some free ammonia. I am enabled also to present a solution containing sulphurous acid, upon which some remarks have been made here, and upon which I have some further remarks to make, as an exhibit to be tested by gentlemen who are now familiar with it. The effect upon the nose and eyes is very distinct, though the odor is not very strong, and the effect upon the throat is very marked in producing a choking sensation, and, if persisted in for a few inhalations, very violent fits of coughing are produced. This gas is simply the same as is given off by a brimstone match, familiarly known as fumes of burning sulphur—brimstone fumes—and the suffocating quality of which every one is familiar with. I shall have more to say about it subsequently.

The next substance which I wish to speak of is phenol. I am not aware that phenol is absorbed by oxide of iron. I am not aware either that its presence in the gas is detrimental either to the illuminating power, or in a sanitary point of view, but it is well known to be absorbed with some considerable power by lime, having an affinity for lime by virtue of its analogy to alcohol, and forming a weak compound, somewhat similar to what are known as alcoholites. When the effete lime is exposed to the air the phenol is doubtless given out again, sooner or later, from the absorption of the carbonic acid by the lime, to the displacement of the phenol. I should consider it preferable that it should be given out in this way, rather than to be distributed with the gas to the consumers, as its odor is disagreeable to most persons, and extremely persistent, and has the nature of adhering to substances for a long time, as every one who has ever had the toothache knows familiarly, who has used it for curing toothache; it is generally called creosote, although it is not creosote but it is sold for creosote, and used for the same purposes, and is similar to it. Gas containing phenol, when leaking, as gas is very likely to do, or let out into the atmosphere, would doubtless have a tendency to leave a more persistent odor than well-purified gas. Phenol is accompanied by other substances, one of which is known by the name cresol, which has a somewhat different odor, but at the same time very persistent.

The next substance I wish to speak of is naphthaline. Naphthaline appears to be absorbed largely both by the oxide of iron and by the lime. There is always danger of too much of it being absorbed by the gas. Its illuminating power being very high, one of the evils of over purification is the abstraction of too much naphthaline from the gas, and the impoverishment of it. At the same time it is dangerous to leave very much naphthaline in the gas, particularly when the gas is not of a very high illuminating power. Poor gas containing much naphthaline frequently would deposit naphthaline in the main, and endanger the supply to the community by choking the mains; hence, I should prefer a process which would abstract from a very rich gas enough naphthaline to prevent this danger, and not abstract enough to impoverish the gas. Gas engineers have generally found the lime process to answer these requests. When a poor gas is in question, experience has shown that naphthaline has a tendency to deposit in any case.

The next substance is bisulphide of carbon. There is much difference of opinion as yet among gas chemists about the relations of this substance to gas, which I attribute to the overlooking of many of the results of the earlier investigators of the substance. I have gone back to those older writings—those of Berzelius and Zeise on this subject. Not to go into the chemistry of the subject in detail, I will merely say that we have here evidence sufficient to justify us in believing that hydrate of lime extracts all the bisulphide of carbon from gas.

Q. How is iron, the oxide of iron, acted on? A. There is no evidence of any action upon bisulphide of carbon by this.

Q. No affinity between the oxide of iron and the bisulphide of carbon? A. Not that I am aware of. Bisulphide of carbon is an especially dangerous and injurious substance in gas, as it is not detectable by any simple means—as lead-paper for instance. Second, it is inodorous. When pure, almost inodorous. In the atmosphere it decomposes and develops an insupportable odor, the cause of which is not well understood, probably owing to the development of hydrogen compounds: as I may say Prof. Silliman has recently pointed out in an item published in the *American Gas-Light Journal.* Bisulphide of carbon, when burning, is converted into sulphurous acid; the sulphur in it is converted into sulphurous acid. There is no reason to believe that it does not undergo perfect combustion in gas. The combustibility, so to speak, of sulphur, may be said to be greater than any other of the constituents of gas. It probably is burned first into sulphurous acid.

The next class of substances are the odorous compounds. These pass chiefly into the tar in all cases. If the gas be scrubbed with water, after it is evolved from the retorts, as it is by the Metropolitan Gas-Light Company, more tar is deposited, and my observations have convinced me that I may say that these odorous compounds are condensed at that stage of the operation. Inferring from the well-known fact that woollen substances have great power to condense these odorous materials—these persistent odorous substances which are found in smoke, say, for instance, tobacco smoke—inferring from this that an instructive experiment might very readily be made, I took a blanket shawl which I have here, and which any one will see at a glance is very appropriate for the purpose, and spread it out in the fumes from one of the fouled purifiers of the Metropolitan Gas Company, which had been opened, and was giving off this stench very perceptibly. This shawl I carried with me and wore it a part of the time afterward, and tried to distinguish at intervals the odor which I supposed would be absorbed. I could not recognize any such odor in the course of, to the best of my recollection, about three hours afterward. I do not mention this as a conclusive test. It is only a very imperfect test. I judge from it, however, that there is much less of this intensely-odorous substance evolved from these lime-purifiers, when the gas has previously been scrubbed by water, as is practised by the Metropolitan Gas-Light Company; for the reason that, on previous occasions, when I have been exposed to the effluvia from open lime-purifiers, or even from that which generally floats from the atmosphere of a purifying-house to some extent, I have retained the smell about me for twenty-four hours, as near as I can recollect. These were instances where the gas had not been previously scrubbed with water. In previously scrubbing, the impurities had been condensed and did not reach the lime. I may say that I was surprised by the result, because I expected in this instance to carry the smell with me. I supposed this shawl was a peculiarly favorable fabric to absorb and retain it. I should conscientiously add that I have heard that the New York Gas-Light Company also scrub their gas as it comes from the retorts. I should like to ask Prof. Chandler whether he knows this is a fact or not?

Prof. Chandler: I believe I do.

Prof. Wurtz: And this would account for the comparative absence of these concentrated odorous substances, when the iron-oxide purifiers are open, and account for the discrepancy between the statements made by experts here, with regard to the comparative absence of these foul odors from the effete oxide of iron of the New York Gas-Light Company, and the opposite published statements made by English authors, Dr. Bowditch and Dr. Letheby, for instance. This, however, has no bearing upon the question as between the oxide-of-iron and the hydrate-of-lime process. This is a question apart. It has, however, a bearing upon the accusations that have been made against the Metropolitan Gas-Light Company, for not exercising due diligence, and not taking due precautions, to avoid offending the noses of the public. The gas itself is another material, given off when the purifiers are opened in both cases. This contains carbonic oxide, a dangerous and well-known violent poison. I have not found that it is pretended, however, by any one, that the carbonic oxide, given off from open purifiers, has ever produced any injury to any one. The supposition is simply absurd, from the fact that it is instantly diffused radially, and that its toxical efficiency must decrease, as the light from a candle decreases, for instance, by radiating from the centre, so that at a very short distance it becomes so diffused and so diluted, that no chemist could detect it in the atmosphere any longer. With regard to sulphide of ammonium, I would suggest that the same remark applies; that the dilution of the material, in diffusing through the atmosphere, must increase as the square of the distance, not simply as the distance; consequently, in a very great geometrical ratio. This was shown by the experiment, the results of which have been already exhibited; in the specimens of lead-paper, seventy-five feet from the purifying house, when the purifier was in full process of oxidation. From a freshly-open purifier, at the distance of seventy-five feet, the delicate test lead-paper no longer detected sulphur in the atmosphere. The question between the lime and the iron process seems, to me, to narrow itself down, as between the alleged nauseating effects of sulphide of ammonium, and the admitted irritating and suffocating effects of sulphurous acid, although in minute quantities. Those who have tested these two materials here, will be able each to form his own judgment upon these two points. I am willing to admit the nausea, though with me the effect is exactly the opposite. Tobacco smoke, for example, is said to produce both effects—the nauseating and the stimulating—upon different persons, and also upon the same person at different times, I believe. Yet, it is scarcely proceeded against as a nuisance dangerous to health, unless inflicted to an excessive degree. Yet a word or two more with regard to sulphide of ammonium, before I leave it. It may not disappear simply by diffusion. The chemical books might be extensively quoted from, to show that it is an admitted fact that sulphide of ammonium oxidates in the air, forming hyposulphite of ammonia. I have in my notes references to Gmelin's Hand-book, supporting this statement, but, as I am confining myself to the sanitary points, I shall not present chemical references. I wish to remark here, however, that this would assist the process of diffusion, in actually destroying the sulphide of ammonium very rapidly, but I wish more particularly to point out that in the open atmosphere there is ozone, which very quickly destroys sulphide of ammonium. In the confined space of a room there is no ozone. Here is an important point which has not been considered by many of the chemical experts who have written upon this subject. This same remark might apply to the disappearance of sulphuretted hydrogen, if it were set free from the fouled purifiers when opened. But I should regard that question as having been fully disposed of, it having been fully conceded that the effluvia from the effete lime contains an excess of ammonia, and no free sulphuretted hydrogen, and I have also presented myself evidence, drawn from the iron process itself, that no free sulphuretted hydrogen can be present, as such, which would be absorbed with certainty by the oxide of iron, according to any principle that I am acquainted with.

The main point remaining, with regard to the sanitary bearing, relates to the nature of sulphurous acid. I must admit, in giving conscientious evidence, that I differ somewhat from many chemists of my acquaintance, on the poisonous power of sulphurous acid. I believe that it is underestimated. I believe that there is a class of men who are constitutionally insensible to the usual effects of sulphurous acid upon the mucous membrane of the air-passages. Individually I am an example, and I believe, in common with a great majority of mankind, of extreme sensitiveness to the action of the most minute quantities of sulphurous acid in the air. There are proofs, however, on record of the poisonous nature of sulphurous acid in very minute quantities, which can be cited. I am referring for instance to the frequent and protracted cases of litigation, particularly in European countries, concerning the effluvia given out by metallurgical furnaces, copper furnaces, particularly, the deleterious effects of which spread for miles around. I found that even with this radial diffusion and this decreasing inversely as the square of the distance, of the quantity in the atmosphere, yet sulphurous acid is still detrimental. In conversation it has been remarked to me that I overlooked, in taking this view, the presence of arsenic sometimes in these effluvia. I did not overlook it. Arsenic is given off in the form of arsenious acid, which is not a gaseous substance. It is a solid substance, which is very quickly deposited and cannot diffuse itself to a distance of miles. Yet there is abundant evidence on record of the diffusion of this actually poisonous influence, both upon plants and animals, about those furnaces where sulphuretted ores are burned—are roasted—to the distance of several miles. In one place, a nobleman's park in Great Britain was entirely destroyed, root, leaf, and branch. These facts must be explainable. I explain them in this way. Sulphurous acid is what is called a cumulative poison, in the language of toxicologists. It is absorbed by water—by moisture and moist surfaces, with gradual accumulation upon such surfaces. It is absorbed by rain, and deposited upon moist surfaces. In this manner it destroys the leaves of plants, doubtless. It is converted into sulphuric acid by oxidation, to some extent at least, slowly—probably very quickly in the open atmosphere, by the action of ozone. I am verging upon the chemical points, so that I will not pursue this further. I think I have said sufficient to illustrate my views upon that head. My belief is that the use by the last generation so universally of brimstone matches, has given rise to a dangerous indifference to the inhalation of sulphurous acid in small quantities, and that the next generation will recognize the view I have taken of the question, that it is one of the most toxical gases, even in small quantities, to whose attacks human beings are liable in ordinary life. I would add that I am told that the French laws have prohibited the evolution of sulphurous acid from the smelting furnaces into the atmosphere at all, in consequence of their recognition of the poisonous character of this gas. In the pamphlet, which I have presented in evidence, the effects of sulphurous acid when set free in a confined space like a room, for instance, are alluded to, in the case of the Metropolitan Underground Railway in London, in which it is averred on good medical authority—the authority of medical experts called in the trials which took place—that the sulphurous acid was the cause of the deaths that have occurred, and, in the course of this trial, Dr. Letheby asserted as the results of his experiments, that one part of sulphurous acid in 100,000 of air is perceptible to the taste and will produce coughing. Dr. Odling, in one of his earlier statements on this subject, presented some views which have been cited here, to which I strongly object in many ways. The article which I allude to has been cited in the *New York Times* of February 12th.

Q. The extract from Dr. Odling's lecture? A. Yes, sir.

Q. Very well, what do you say about that, professor? A. Dr. Odling makes a calculation here, which I have not critically examined, but he presents the point that the fact that the sulphurous acid produced is diluted, with a thousand times its volume of carbonic acid, it is liable to render it less poisonous. Dr. Odling has overlooked the view that I have presented of the cumulative character of sulphurous acid as a poison; and taking that into consideration I would regard its dilution with carbonic acid merely as calculated to intensify its toxical action and make matters worse. The depressing effect of carbonic acid upon the system is well known, and if you add sulphurous acid, with the irritating effects of the sulphurous acid upon the air-passages, you have a combination of circumstances very unfavorable to health. There is no doubt that in the upper portions, as Prof. Silliman has already stated, of crowded assembly rooms, where gas is burned extensively, such as theatres, churches,' ball-rooms even, and many other similar places, these injurious gases produced from the gas-burners would exist in much larger proportion than Dr. Odling admits here. That is another point which he does not take into consideration. His supposition, that the amount of ammonia ordinarily existing in the atmosphere can neutralize 20 grains of sulphur in the gas, strikes me as simply absurd. I have calculated that, for neutralizing 20 grains of sulphur, if converting it into sulphate of ammonia is a neutralization, it would require 21 grains of ammonia. Every chemist, who knows that an ordinary atmosphere contains an amount of ammonia almost infinitesimal, will see the unreasonableness of Dr. Odling's suggestion here. One hundred cubic feet of gas containing 20 grains of sulphur—or 45 as Prof. Chandler has stated, I think, was contained in the New York Gas-Light Company's gas purified by the oxide of iron—100 cubic feet of such gas would require very nearly 50 grains of ammonia to convert its sulphur into sulphate, or sulphite, of ammonia.

Q. I want you to state in as few words as you can the inefficiency of the oxide-of-iron process of purification in eliminating these contaminations, and the efficiency of the lime process in eliminating them—briefly, and as it is affected by this question of sulphurous acid of which you have been speaking. I wish a practical application made of what you have said there of the poisonous character of sulphurous acid, and how it is affected by those two systems of purification, or how the two systems of purification bear upon it? A. It is in evidence from the researches of chemists that bisulphide of carbon, as well as the sulphide of ammonium and other sulphuretted compounds detectable by lead-paper, should be completely absorbed by hydrate of lime. There is no direct evidence that oxide of iron can absorb all the sulphide of carbon.

Q. Now then, the bisulphide of carbon and the sulphide of ammonium being left in the gas, after it has been subjected to the action of the oxide of iron, where and under what circumstances do other injurious effects present themselves? A. When the gas is burned, according to the experience of all mankind.

Q. When the gas is burned in dwelling-houses or public places, the presence of these contaminations is then experienced in the form of what? A. Sulphurous and sulphuric acid; the weight of evidence is so great on that point as to make the facts notorious.

Q. And which are destructive to property? A. Destructive to property, irritating to the air-passages of most persons, and peculiarly so in crowded places, and especially in the upper portions of the atmosphere of such crowded places.

Q. Now then, what kind of gas would you call that to be which exhibits the presence in it of from 21 to 45 grains of sulphur per 100 cubic feet? A. I should regard such gas as objectionable; I should prefer such gas as was purified down to 20 grains, or as low as possible; down to 10 or 12 grains, as the Manhattan Gas-Light Company, for example, claim to purify their gas.

Q. I will ask you the question whether you consider the emanations and exhalations from the spent lime, when the purifiers are open, as deleterious to health? A. I cannot view them in any light which will justify such an estimation of them; I am not aware of the slightest evidence which would justify any such view.

Q. Now then, you have been present at the New York Gas-Works—you have been at the New York Gas-Works where the oxide-of-iron process of purification prevails? A. I have, sir.

Q. Have you been there when the purifiers were opened and the foul iron was exposed to the air? A. I have.

Q. Will you state, if you please, whether they gave forth any odor, and, if so, what was the character of them? A. I perceived the characteristic odorous substances, which have been the subject of complaint, but not to so great an extent as I have perceived them on other occasions about large gas-works.

Q. Are they not inevitable—the presence of unpleasant odors when the purifying material, whatever it may be, as far as your experience extends? A. I have seen purifiers opened at large gas-works—

Q. I mean such as you have spoken of? A. I have seen purifiers opened in large gas-works when these odors were so slight that they might be called imperceptible.

Q. What gas-works was that? A. In the Manhattan Gas-Works.

Q. That is where this new system of ventilation, of which you have spoken, prevails? A. Where the effete lime was thoroughly ventilated by the passage of the air through the closed purifier, and the mass converted into a porous substance something like chalk and inodorous; a specimen of it has been produced here.

Q. You have visited the works of the Metropolitan Company? A. I have on several occasions.

Q. I wish you would state your general conclusion as to the managment, manipulation, and products of the Metropolitan Gas-Light Company? A. I have made several visits. One of them was on the 30th of January, 1869, when a fouled purifier was opened especially for me at 10.30 in the morning. This purifier was 20 feet by 20, and with six tiers of trays. It contained between 200 and 250 bushels of lime, and very nearly 1,000,000 feet of gas had been put through this lime during the 24 hours immediately previous; atmosphere of purifying-house strongly ammoniacal and distinctly stimulating.

Cassidy, the foreman, stated that he had been six years in this purifying-house, and seventeen years in all in the same employment, having come from the Manhattan Works; was 56 years old, appeared robust and with healthy and florid complexion; stated that the men under him were all strong and uniformly healthy, but suffered from temporary irritation of the eyes from the strongly ammoniacal atmosphere when the boxes were being emptied; gas not over-purified, as it still indicated small traces of sulphur and ammonia.

I would remark, that I ascertained on that occasion that the time of cleaning these large purifiers was about one hour, which is a very short period, if I am not mistaken, and indicates diligence in getting their material out of the way as much as it can be. I collected some samples upon that occasion which have already been exhibited here. Subsequently I made a visit, together with Prof. Silliman, on which we made those important tests with lead-papers, and made a thorough examination of the works. I agree with Prof. Silliman in the general conclusion that the management of the Metropolitan Gas-Works is quite as careful and cleanly as is compatible with the working of so large an establishment. Excepting this one point, which might be excepted, relating to the ventilation of the lime in the purifiers, which I regard as entirely extraneous to this question, a general answer would be that the management and manipulation of the Metropolitan Gas-Works is as careful and as cleanly as that of any other large gas-works which I have visited.

Witness: I would ask the counsel whether he wishes the question to relate to the future course—whether he wishes to ask my opinion as an expert as to what should be the future course of the Metropolitan Gas-Light Company.

Judge Van Vorst: No; that is not in relation to this question.

Q. You have stated that the oxide of iron has no affinity for, and does not remove the, bisulphide of carbon, is that so; what would be the effect of subjecting the gas, after the oxide of iron had acted upon it, to the hydrate of lime or wet lime; what effect would that have upon it; what office would that agent perform, and how would it affect the gas to be delivered? A. It would depend upon the quality of the gas; it would depend upon the richness of the gas.

Q. What effect would it have upon the illuminating power of the gas? A. It would decrease the illuminating power of the gas inevitably; it would amount to over-purification, technically so called by gas managers.

Q. And over-purification has a deleterious effect upon the gas, has it not? A. Upon the illuminating power of the gas.

Q. Then there is such a thing as over-purification of the gas? A. There is.

Q. And that would be the effect of subjecting the gas to this double method of purification of the iron and lime afterward? A. It would.

Q. Now, Prof. Wurtz, I desire to ask you, as an expert, your opinion as to the suggestion that has been made to substitute the use of the oxide of iron for lime by the Metropolitan Companies as a method of purification? A. I think it is incumbent upon gas chemists and upon the whole community to be taught by past experience in deciding such questions; we are now repeating a chapter of history here—a chapter of history which has been passed through by the gas manufacturers of Great Britain more particularly, and even to some extent by our largest company—The Manhattan Gas-Light Company. Complaints relating to this so-called nuisance, from municipal authorities, have been abundant in all civilized countries where large cities are lighted by gas. In England this was carried to such an extent that the gas companies were brought up so often as nuisances before the police courts, that they adopted the use of the oxide of iron, thinking that in that way they would get rid of a portion of the smell, and make matters better. The tendency, however, at the present time, is to go back again. The first result was that the amount of sulphur increased in the gas. I wish to add here, with regard to bisulphide of carbon, that it is considered by gas chemists as a very slippery thing. The same coal from the same heap varies very greatly in its product of bisulphide of carbon; sometimes the quantity being so very great that it is stated the gas will give off the smell of brimstone matches. The point which I wish to bring forward is, that bisulphide of carbon may occur in gas occasionally to a very large extent, owing to causes as yet unknown. Sometimes a coal which is found by analysis to be comparatively free from sulphur will give a very sulphuretted gas, from which the sulphur cannot readily be removed by the ordinary modes of purification. Until we know more about bisulphide of carbon, I think I would be cautious in substituting for the agent—the hydrate of lime, which is known to absorb it—any other agent which is not known to absorb it.

I wish to make one or two further remarks. I have already spoken of the danger also of oxide of iron catching fire, which seems to be spoken of as one not yet entirely mastered by our gas chemists.

Q. Is there a danger to be apprehended from the oxide of iron catching fire? A. Where a vast mass of it is used, as would be in a large gas-works like the Metropolitan and is kept lying about, I should regard it as a danger which must be taken into consideration in advance of any extended or continued series of experiments upon the subject.

Q. What is its liability to take fire attributable to—to the presence of what in the iron do you attribute that? A. To the presence of sulphuret of iron or sulphide of iron. The effects of its taking fire is to give off large quantities of sulphurous acid, which would render the atmosphere of the neighborhood of the works intolerable.

Q. That would be the effect of it? A. Yes, sir; with regard to the management of the Metropolitan Works, there is another point I find that I noted down in reference to statements that have been brought forward, which I believe are rather ancient, being taken from Ure, of men having been suffocated in sewers, wells, and pits, and so on, by the emanations from waste lime. I would simply remark that the only reasonable inference to be drawn from this is, that waste lime should not be used in that way to fill up such places; that it should be managed precisely in the way that the Metropolitan Gas-Light Company do manage it. It should be spread out in the open air so as to become ventilated and oxidized, and the sulphur compounds destroyed, so that they cannot collect together in depressions and cause danger and produce deaths in that way.

Q. I ask you whether you observed in the neighborhood of the Metropolitan Gas-Works any causes which would be likely to produce contaminating or deleterious odors. A. On the occasion of one of my visits I smelled a very putrid odor, which I was informed proceeded from an establishment for the boiling up of the carcasses of dead horses, the location of which was pointed out to me, and from which the wind at that time blew directly, as I observed.

Q. Where was that establishment? A. At the foot of Thirty-eighth Street, three blocks south.

Q. Was it such an odor as would be likely to proceed from such a cause as that? A. I should have said I perceived it on two occasions. On one occasion Prof. Silliman was with me, and he pointed it out to me, and we both remarked its entire distinctness from the odor of the gas-works. The wind was blowing in such a direction that no smell could come from the gas-works.

Q. Was it an odor that would be deleterious to health? A. I should think it was an odor decidedly deleterious to health. There is another large establishment that is known by the name of a piggery. I did not go inside of it, but I infer also from the odor, which was the usual odor of a pigsty.

Q. How near? A. Next door to the Metropolitan Gas-Works.

Q. It extended how far? A. It extended nearly the whole of the long side of the block between Eleventh and Twelfth Avenues. I wish to add that I have consulted some of my chemical friends about this question as to the character of these odors, which are known to spread through the city on certain occasions, and I have found several who have concurred with me in the idea that they were not always from the gas-works; that there are odors which spread over New York from other sources, and which they recognize as such—sometimes as the smell of putrid matter. I think the gas-works have received the blame of all these things. Injustice has been done them to that extent. I would add: I believe it comes under the present head that we are talking of, that there would be considerable difficulty and injury in at once arbitrarily changing the system in use by the Metropolitan Gas-Works at this season. It could only be done at a season when the consumption of gas is at a minimum.

Q. What season is that? A. In the spring, I suppose; in April.

Q. Have you stated already when the process of ventilation of effete lime in use by the Manhattan Company was first made known to the public? A. It was first really made known to the chemical public by its publication in the London *Journal of Gas-Lighting* during the last month—the preceding month of January.

Q. Of this year? A. Of this year. It has really not been made known to the general public in such a form as to be available practically at all.

Q. There have been no specifications of it published? A. There have been no specifications.

Cross-examined by *Mr. Bliss:*

Q. In your opinion, is there any necessity for the Metropolitan Gas Company to conduct its operations of the manufacture of gas in a way that gives off the offensive odors that are given off when its purifiers are changed? A. Not permanently.

Q. Had they, on the 14th of July last, or the 15th of July last, gone to work to remedy the offensiveness, could it not have been done long before this time? A. Well, I am not really bound to answer a question which relates more especially to gas engineering. I do not feel competent to answer. The impression on my mind is, that they might have done it. It is merely an impression; that is, if they had the specifications before them.

Q. Is not the process of purification by ventilation a modification of Palmer's process, which has been known for a long time? A. I should say not. It is an improvement—an additional improvement or appendage to the Palmer process, and throws out, also, some portions of the Palmer process.

Q. Is it a patented process? A. I do not know whether it is or not. I have no right to know any thing about that.

Q. Is there any difficulty in any other gas company gaining the means necessary to put that process in operation—I mean by inspection there? A. There is no difficulty in their gaining a knowledge, I presume. I know of no such difficulty. The Manhattan Gas-Light Company have offered no obstacles to inspection, so far as I am aware, although I am not familiar with their police regulations; but, as to their being able to do it, that depends upon conditions that I am totally ignorant of.

Q. What conditions? A. That was answered in my previous answer—as to whether it is patented, or is going to be, or is caveated.

Q. Suppose the chemist of the company goes there to-morrow, can he get access to the information necessary to put this process in operation? A. I cannot answer that question. I have no authority to answer for the Manhattan Gas Company.

Q. Then, if there are no means, to your knowledge, of putting that process in operation, we will leave that out of the question? A. I do not know that I am to decide as to whether we will throw that out of the question or not.

Q. How long has that process been in operation in the Manhattan Company? A. I am not familiar with the history of it, except in a very general way, and by hearsay. I have been informed that, in its present form, it has been in use some two or three years.

Q. At the Manhattan Works? A. Yes, sir. In a form somewhat approximating to what it is now. I am told it has been longer in use, but I could not give the details. The Manhattan Company has made many experiments. They have tried the iron process very extensively, and failed to succeed with it.

Q. That I do not want to go into. I confine myself to one class of questions at a time. Has not the ventilating process, as applicable to the additional purification of gas, been known to gas engineers for a long time? A. It has been known, but unfavorably.

Q. And no favorable process known until this was got out? A. Not that I have heard of. There have been dangerous accidents frequently from the attempts.

Q. Which of the processes, now in use in this city, of manufacturing gas is, in your opinion, the least offensive? A. I can have no hesitation in saying the process in use by the Manhattan Gas-Light Company.

Q. Which is the next? A. I am not familiar with the process used by the Harlem Company.

Q. I confine myself to the Metropolitan, New York, and Manhattan. The Manhattan is the best, you have said. Now, which is the next, in the sense of being the least offensive? A. To whom?

Q. The least offensive in the process of manufacturing. This order expressly says, or it speaks, of the process of manufacturing. It looks to that. A. I cannot answer the que s tion. I have never made but two visits to the New York Gas-Light Company when they were opening the purifiers, and I cannot speak from so little experience and observation.

Q. If you cannot speak as to that, how could you speak so in your pamphlet, and in your testimony, as to the merits of these processes—of the New York Gas Company's process? A. Simply because I observed the facts stated in the pamphlet. I observed an offensive smell.

Q. But you did not observe sufficient to enable you to say whether that process was more offensive than the Metropolitan Gas Company's process? A. I will make an answer to this point—which, I presume, ought to be satisfactory—that, on the occasion on which I visited them for this special purpose, the New York Gas-Light Company's works, and the Metropolitan Gas-Light Company's works, on these special occasions, I observed a worse smell at the Metropolitan Gas-Works than I did at the other, as far as smell is concerned.

Q. And all your knowledge as to the matters connected with the iron process, you derived from what knowledge you obtained at those two visits? A. I cannot say that.

Q. Have you had any more opportunity of ascertaining the effect of the New York Company's process than you have had as to the question of its offensiveness? A. As has been remarked here before, there are many iron processes.

Q. I am talking of the New York Gas Company's iron process. Have you had any more opportunity? A. Not of that special modification; I have not.

Q. In changing from the lime process to the iron process, is any thing more needed than only changing the purifiers, and removing the trays and putting in iron instead of lime? A. That is strictly a question for an engineer to decide. The difficulties met with would, probably, be more in the collateral and subsidiary arrangements or fixtures necessary than in the mere cleaning out of the lime and putting in iron.

Q. What fixtures do you refer to? A. As I stated before, I am not specially familiar with the New York Gas Company's process. I have seen their material spread out on the floor of their purifying-house and in the open air, but I cannot state how much space they require to spread it out.

Q. I am talking about the space they require for revivifying. Suppose they desired to change to the iron process, would they need any thing more when the purifiers were changed than to take out the trays and put in iron instead of lime? A. I should regard that merely as a question to be decided by reference as to the facts of what the New York Company did under the circumstances—the modifications of their machinery.

Q. Is that the fact that that was all the change they made? A. I could not say whether the New York Company made any change in their fixtures.

Q. Then, any thing you have said as to the impossibility of the Metropolitan Company's changing to the iron process, you do not know, as a fact, whether they can or cannot, nor as to the time it would take. A. So far as the mere substitution of the iron for lime is concerned, I could not.

Q. Accepting the fact that the iron can be substituted for the lime, what other thing is there involved in the change, which will take time. Is there any thing more than a sufficient space for the revivification of the iron? A. In answering that question the most prominent point that comes to my mind is as to whether they would be able to command trained workmen, familiar with the iron process.

Q. Does it require any trained workmen? A. I should think it extremely probable it did. My experience is to the effect that no modification, in any great manufacturing operation, however small, can be carried on, however simple, without trained workmen.

Q. Do you not know, as an actual fact, that at the New York Gas-Works the men are not trained? A. In the peculiar process relative to the iron—I do not speak of mere laborers, I mean the men who are relied upon to see to it—the responsible men who are competent to meet any unlooked-for contingency.

Q. Do you not know that the parties controlling the process in use at the New York Gas-Works have made an offer to furnish all the assistance necessary to introduce that process elsewhere? A. It may be so, but I have not encountered the information.

Q. Have you not seen their circular? A. I have not, that I remember. I have not read it.

Q. Are not all the processes used in this city by the three large companies for the manufacture of gas, unhealthy? A. I should regard the iron process as having a tendency to affect the public health injuriously.

Q. In what way? A. By leaving the sulphur in the gas.

Q. You mean by introducing it into the rooms? A. Yes, sir.

Q. Now, taking that iron process and applying lime to it subsequently, would it then remain unhealthy? A. Probably not, it would only affect the eyes of the public.

Q. The effect would be deleterious to the illuminating power of the gas, would it not? A. I should apprehend that it would.

Q. Then, if the companies were required to introduce that ventilating process of lime, after the iron, and were required to furnish, for a given sum of money, the same illuminating powers, the only deleterious effect would be upon the stockholders, would it not? A. That is scarcely a question for a chemist.

Q. Unpleasant odors are not unavoidable in the practical manufacture of gas? A. It has been recently so discovered by the Manhattan Gas-Light Company.

Q. And that by the process which has been in use two or three years? A. Secretly; that is, it has not been a matter of publicity.

Q. Has there been any difficulty in any way, so far as you know, of gaining access? A. Not so far as I know. I have found the doors open.

Q. Why did you say secretly? A. Secretly may be too strong a term. I mean privately—it has not been a matter of publicity.

Q. Have all of the gas companies and yourself known all about it? A. I think not, from the fact that I have talked with officials of the gas companies, who, until quite recently, had not understood the nature of it.

Q. What officials do you refer to? A. That I do not think I should be called upon to say.

Q. Any officials of the Metropolitan Gas Company? A. No, sir. I could not specify any officials of the Metropolitan Company.

Q. Was or was there not any one of that company? A. I do not remember any especial individual.

Q. When were you consulted by the Metropolitan Company with reference to any question connected with their manufacture of gas? A. I could not remember the precise date. The president of the company called upon me first in connection with matter some time in August last, I believe.

Q. What then happened—was there any thing more than asking you to suggest something? A. The salient points of that interview which recur to my memory are, that the president desired me to recommend to him some gentlemen who would be competent to take up the investigation of gas purification, with a view to the improvement of their process.

Q. At that time you knew the Manhattan gas process was in operation? A. At that time, yes, sir. Previous to that I had been examining it.

Q. You satisfied yourself it was successful? A. I was not so strongly decided about it as I became afterward. I was making up my mind in that direction.

Q. After that time, when did you first do any thing further in connection with the Metropolitan Gas Company's process? A. Not until within a few weeks. I was not called upon until a few weeks since. I cannot remember the precise date at this moment.

Q. Have you not a personal knowledge of the iron process in use abroad? A. I have not, sir, from observation.

Q. You do not know how the New York Company's process bear comparison with them? A. Not from observation—no, sir.

Q. You heard Prof. Silliman's testimony? A. I was present at the whole of his testimony, I believe. I heard most of it—yes, sir.

Q. Is there any portion of it you disagree with? A. There may be some minor chemical points involved in which I did not agree with him. I have already alluded to one point—as to my estimation of the actual poisonous character of the sulphurous acid in small quantities.

Q. Is there any thing else that occurs to you? A. There were other points which I really cannot recollect at this moment.

Q. Any thing of any importance? A. Nothing of any essential importance bearing upon this question, that I recollect.

Q. You spoke of ozone in the atmosphere—is there any great quantity of ozone in the atmosphere of cities? A. It is very varying, as a general thing. It has been found in the atmosphere of cities constantly by tests applied.

Q. Is not its amount very much less than in country atmosphere? A. Its amount is small, but it is believed to be constantly present and constantly reproduced.

Q. Is it not much smaller than in the atmosphere of the country? A. I do not recall the facts distinctly enough at this moment. My impression is that it is so—that in cities it is usually smaller than in the country. That depends upon the proximity of the sea-coast, I think.

Q. Do you consider yourself a sanitarian? A. Only so far as I have had my attention drawn a good deal in the course of my studies, and in my practice; though to subjects rather connected with therapeutical subjects than sanitary.

Q. How as to physiological matters? A. I could scarcely call myself a thorough physiologist; toxicology I have studied pretty thoroughly—the science of poisons.

Q. Is not any thing injurious to health, in a greater or less degree, which changes the natural composition of the atmosphere we breathe? A. I do not know that I get the full sense of the question.

Q. Is not any thing which changes the composition of the atmosphere which we breathe dangerous to health in a greater or less degree? A. I should say the question was scarcely definite enough for me to answer yes or no.

Q. Is the healthiest atmosphere that which nature has made? A. That is decidedly the dictate of experience.

Q. If any change of any kind is made in that, does it not in a greater or less degree make it unhealthy? A. The atmosphere itself is variable somewhat.

Q. Can you answer my question or can you not? A. It is simply a question as to the degree of the change, and the kind of change. There are many changes that could be made, which would not affect the health appreciably or at all. Most atmospheres might even be changed for the better, as regards health.

Q. Now, the Manhattan Company's process—what change would it require to introduce that at the Metropolitan works? A. That is also a question which the engineers would have to answer. I could say, generally, that additional buildings would be required; and, I presume, an additional exhauster, or engine of some kind, for producing a current of air through the purifiers.

Q. What additional buildings? An additional building for the supplementary purifier at least.

Q. Any thing else? A. It would require an additional engine-house, and room for the exhauster. This additional building for purifying is nothing more than a brick building—perhaps twenty feet square. That is a very small matter. The engine and boiler would be the main thing—the engine for drawing the air through.

Q. Is that a matter requiring any great time? A. I believe it generally takes some time to set the boilers and erect an engine, and get them in working order.

Q. It is simply the time necessary to set a moderate-sized engine. A. I presume so, so far as I can say, not being an expert in that particular branch.

Q. You have spoken of over-purification, and of the effect of absorption of naphthaline; what is the effect of it?—any thing but to reduce the illuminating power. Is it any thing other than that? A. I don't know that it produces any other injurious effects.

Q. I understand you to say that, in your opinion, the New York Gas Company's process allows too much sulphur to pass into the rooms? A. That would seem to be the conclusion, not only from general experience in the iron process, but also from Prof. Chandler's direct investigation.

Q. You state, in your pamphlet, that "the Metropolitan Gas Companies have conse quently been unable to comply with the conditions required by the Metropolitan Gas Act of 1860, that the gas shall not contain more than twenty grains of sulphur in 100 cubic feet." Speaking of the London companies, you consider the parliamentary requirement, reducing the sulphur to twenty grains in one hundred cubic feet, as reducing it to the point of health? A. I consider gas containing twenty grains of sulphur as still decidedly objectionable, if better can be done.

Q. Then you consider that the parliamentary limit of twenty grains, to which the London companies have been enabled to reduce it, as still leaving it unhealthy? A. Under circumstances favorable to the development of its detrimental effects, I should.

Q. Schultz is a competent chemist, is he not? A. In gas matters he is a very good chemist.

Q. Then, when he states that the New York Company's iron process has reduced it to 12.91 grains of sulphur in one hundred cubic feet of gas, you admit that is about one-half less than the English parliamentary limit? A. I should not attach so much importance one way or another to those figures given there, as to the quantity of sulphur. They are both, in my opinion, lower than is probably the truth—considerably lower.

Q. Then why do you say in your pamphlet, "The most striking fact, developed by the above short but significant report, is the high degree of freedom from sulphur of the gas of the Manhattan Company," if you did not believe it to be true? A. I spoke there of the report.

Q. Why did you, in a report to the company, quote another report which you did not believe to be true, and state "that that was exceedingly significant and satisfactory?" A. It would be rather strong language to say that I do not believe the report to be true. I believe it to have been low in all probability; the word believe is too strong a word to use in the connection, in my opinion.

Q. Do you believe that this report of Mr. Schultz is correct? A. I think in the main it is.

Q. Do you believe it to be correct in its statement of the sulphur in the gas of the New York and Manhattan Companies? A. I have no belief on the subject. I think it is not strictly correct.

Q. How long have you so thought? A. One important piece of information, which led to the modification of my opinion upon that subject, was Prof. Chandler's investigation.

Q. How long have you so thought it was not correct? A. Since I have myself been occupied with Prof. Silliman, within two months past, in some determinations of the sulphur in gas, which have led me to believe that some determinations of the sulphur heretofore made have been too low.

Q. Then, I understand you that you consider this report of Mr. Schultz, so far as it relates to the amount of sulphur, as valueless? A. Not altogether valueless.

Q. If incorrect is it not valueless? A. The results of Mr. Schultz and Dr. Torry were doubtless obtained by the method which has been in ordinary use by gas companies for determining the sulphur, and which was introduced by Dr. Letheby. Several other chemists have recently come forward with the opinion, within the last year, that all the determinations made by Dr. Letheby's apparatus are too low, and that the amount of sulphur is much higher than has been placed by him, showing that the amount of sulphur, as indicated by Dr. Letheby's method, is incorrect.

Q. It is the method which has been used in England for determining whether the companies there have conformed to the parliamentary standard? A. Yes, sir, and it is very seldom that it has given twenty grains, until quite recently.

Q. If, by a process which is used abroad to determine whether the gas comes up to the parliamentary standard, it is found that the oxide-of-iron process gives eight grains less of sulphur than the parliamentary standard requires, does it not show that that process is superior to the process in use in London? A. A great deal depends upon the coal that is used in making the gas. If very pure coal is used, free from sulphur, applying the same process of test abroad and here, we get eight grains less in the New York Company's process than is required by the parliamentary standard—between seven and eight grains.

Q. Taking that same test, does that not show that the iron process in use by the New York Company is, so far as sulphur is concerned, superior to the process in use abroad? A. It would simply show, to my mind, that it is probable that just at that particular time the New York Gas-Light Company were operating in some way; either by the aid of coal favorable to such a result, or by that combined with other means, of scrubbing, for instance, which they use, as I am told, so as to produce a gas very free from sulphur. I do not know that the oxide-of-iron process—I do not know that it would be right to attribute the whole result to that.

Q. Here is a test that is used abroad, which gives between seven and eight grains of sulphur less to one hundred cubic feet than the parliamentary standard requires. Now, it being stated by yourself that the companies in London cannot even come down to the parliamentary standard, does not that fact show that the process of the New York Gas Company furnishes a gas purer and more free from sulphur than that of the London companies? A. Speaking of the whole process of the New York Gas-Light Company, I should answer in the affirmative.

Q. I understand you to agree with Prof. Silliman in saying this; in so far as purposes of health are concerned, the question of naphthaline and phenol may be left out of this consideration? A. I consider them very minor matters.

Q. Do they have any bearing whatever other than the fact that phenol is a disinfectant? A. I should prefer to throw them out of this consideration. I think they bear about as much upon the one side as the other, in every aspect, both *pro* and *con*.

Q. Is not sulphide of ammonium found in gas purified by the Manhattan process? A. I have not recently tested the gas of the Manhattan Company. So far as my own knowledge extends, they do not deliver gas containing sulphur.

Q. Was not the sulphide of ammonium found in the purified air, on being delivered from the supplementary purifier? A. It was, but in a very minute quantity. It was scarcely perceptible to the smell, though it was to lead-paper.

Q. You have used in your direct testimony, at various times, the words: "There is no evidence, that so and so occurs in or is accomplished by the iron process." What do you mean by that? Do you mean that you have not investigated it sufficiently to say that these things are accomplished, or what do you mean? A. There is more than one case of the kind, to which different answers would apply. There are cases in which, if I remember aright, I made use of that remark, in which the matter has been investigated.

Q. The expression is peculiar, "There is no evidence." A. I mean that we cannot proceed in chemical matters any more than in legal matters, without some evidence—without facts to start from.

Q. When you say that there is no evidence, that such and such things are eliminated by the iron process, do you mean that does not eliminate, or simply that you do not know that it is eliminated? A. I simple mean that no chemist has ever brought forward any evidence, from experiments, that it has been eliminated.

Q. Do you mean that no chemist has ever brought forward any evidence, that it has not been eliminated? A. In some cases I do. In the case, for instance, of the bisulphide of carbon, some chemists have made very extensive experiments with bisulphide of carbon. They have found compounds of bisulphide of carbon with lime, but they found none with oxide of iron that I could find any evidence of.

Q. Do you know whether they looked for any? A. No, sir; I cannot say that.

Q. Did they say that they found none, or simply failed to mention them? A. If they had found them they would have mentioned them.

Q. Do all gas companies apply the scrubbing process. Is it in use by all companies? A. No, sir; not by all.

Q. Is it in use by all the companies in this city? A. I think the Manhattan Gas-Light Company do not scrub their gas before condensing it.

Q. In speaking of the hydrosulphuric acid and hydrosulphate of ammonia in your pamphlet, you say that "in the lime process the conditions present themselves merely for the arrest of all the free carbonic and hydrosulphuric acids, and free ammonia salts, in definite forms of combination. In the case of the iron process this can by no means be asserted."

Q. Do you mean to say, by that, it is not true of the iron process? A. No, sir; I mean that the weight of evidence is very much against it in the case of the iron process—the testimony of facts and investigations, so far as they have gone.

Q. In speaking under the head of carbolic and cresylic alcohols at its close, you refer to the advantage of the lime, and then say, "which, however beneficial under peculiar circumstances, cannot be regarded as, by any means, indispensable and desirable as a compulsory infliction upon consumers of gas." What do you mean by "peculiar circumstances?" A. I mean in case there are bad smells or an infectious atmosphere. Carbolic acid or phenol might then be even beneficial, but that, under ordinary circumstances, the delivery of gas containing creosote and like substances would be objectionable in private houses. I should class phenol—however, I believe we have concluded that phenol is a matter of such minor importance, that it might as well be thrown out of consideration.

Q. On page 13, you make a quotation from the last edition of Clegg, and then one from Bowditch, and say that you are inclined to agree with Mr. Bowditch. I understand that to be your present view? A. The first paragraph, although taken from the edition of 1866, is very likely a copy taken from the previous edition.

Q. Then, I understand the view you there express to be the views you now entertain? A. Do you refer to the passage commencing, "I am constrained?"

Q. Yes, sir. A. I still have that opinion.

Q. If you are of the opinion that there is still a worse smell at the Metropolitan Company's works, when they change their purifiers, than at the New York Company's process, what opinion do you entertain then of the Metropolitan Company's process? A. I stated at the very outset of my examination, I am confident, if my recollection serves me, that there was a bad smell given out by the Metropolitan works.

Q. The point is here. You make a quotation, in which you say, "The vapors of the hydrocarbons are much heavier than the atmosphere, and, when evolved from the foul oxide of iron by the heat of chemical action, they float in the lower stratum of the atmosphere, near the surface of the earth, and produce extensive nuisances. There are few smells more offensive to many persons than the smell of these compounds given off by the oxide in the process of revivification, and in every gas-works. They ought to be consumed instead of being allowed to escape. If this be not done voluntarily, the law ought to compel it." Then you say, "I am constrained to state that my own observation, so far as the natural capacities of my mind and senses extend, bears out the positive assertions of the Rev. Mr. Bowditch in the latter paragraph." Having stated that, and having stated further here, that the smell from the Metropolitan Gas Company's works is more than that from the New York, what, in your opinion, should be done with the smells given off by the Metropolitan Company's works? You said they ought to be burned up in the other case? A. They should most certainly be prevented by the best means which offer to accomplish that result, because they are unpleasant to the public. I should state, however—I certainly ought to be allowed to recall—that when I stated there was a worse smell at the Metropolitan Company's, I spoke of the works, and not of the neighborhood, at a greater or less distance from the works; because I should say precisely the opposite with regard to that. At a little distance from the New York works, I perceived a bad smell, and across the street from the Metropolitan works I perceived a very slight smell.

Q. Do I understand you to say that the smell from the Metropolitan Company's works is not perceptible at a distance from the works? A. I have not succeeded in perceiving it at a distance of about one block from the works—I mean the offensive stench. I have not happened, it may be a mere accident, to catch the very offensive stench which has been spoken of.

Q. You say on page 15, "as regards the peculiar unknown substance which diffuses itself from the purifiers when opened." To what purifiers do you refer? A. I was then speaking generally of the ordinary dry-lime process of purification, without any assistance from other devices.

Q. You are still of the opinion that that odor has a resemblance to, or belongs to, the class of sickening odors, and is developed and intensified by aërial dilution? A. I have perceived such odors.

Q. Are you still of the opinion expressed in that passage? A. In connection with my last reply, I am.

Q. How do you account for the fact that it is intensified by atmospheric or aërial dilution? How do you account for the fact that you smell it at the works and do not smell it across the street? A. I did not smell it at the Metropolitan Gas-Works, as I have said in my direct evidence. I have tried to catch some of it in a shawl and could not get any of it.

Q. You smelled some of that class of smells? A. No, sir. The smell at the Metropolitan Gas-Works was a different smell from that referred to. I did not perceive any of this smell at the Metropolitan Gas-Works at the time I visited them.

Q. Then you did not smell, at the Metropolitan Gas-Works, the peculiar unknown substance which diffuses itself from the fouled purifiers when opened? A. Certainly not so much as I have perceived, for example, about a building, the roof of which was having coal-tar put upon it.

Q. Then, if you did not perceive peculiar odors which came from fouled purifiers, to what odors did you refer when speaking of the smell as being offensive? A. In the Metropolitan Gas-Works?

Q. Yes, sir. A. I referred to the smell of sulphide of ammonium, which was perceptible in the purifying-house, and to a certain distance around it.

Q. Did you perceive any other offensive smell than that of sulphide of ammonium? A. I perceived the smell of naphthaline, which is rather pleasant to me.

Q. Did you perceive any offensive odor from the purifiers? A. I have already stated that I perceived an odor which was usually classed as offensive.

Q. But it was not the odor you referred to on page 15? A. I did not recognize it as such. I attempted to account for that in my direct evidence by attributing it to the scrubbing of the gas—the copious quantity of cool water which has taken off all these offensive materials, in all probability, to the tar-well.

Q. Have you ever heard of the oxide-of-iron process catching fire? A. It is spoken of frequently in books. I have not had it under my personal observation.

Q. Do the books say that it has caught fire, or that there is danger of it? A. They say that it has caught fire, I believe.

Q. At this time that you went to the Metropolitan Gas Company and did not perceive these odors from the purifiers—was your arrival there expected, were you there by appointment? A. On my first visit, when the purifier was opened, it was expected; but I am not aware whether it was or not on the visit which I made with Prof. Silliman. I do not think it was expected, certainly the time was not set.

Q. What is your opinion as to the proper future of the Metropolitan Gas Company as to its process of manufacturing? A. It was answered in great detail by me, to the best of my recollection, in my direct testimony. I gave my opinion as an expert that the Metropolitan Gas Company should be guided by the past experience of other companies—by the past history of this controversy, as it has taken place already.

Q. Is it not your opinion that they ought to put the process in use which is used at the Manhattan Company's works? A. I do not feel as if it were a proper question to ask me on this occasion. I have no objection to reply to it, if it is insisted upon. I do not look upon myself as called upon here as an expert to advise the engineers of the Metropolitan Company as to their duty.

Q. You are here as an expert. I will put it another way. Is it your opinion that, out of consideration to the public convenience—leaving health out of the way—a gas company, having its works situated as the Metropolitan Company's are, should introduce the Manhattan Company's process? A. So far as my knowledge of gas purification extends, I should think, if I am required to give an answer to that question, I should answer in the affirmative.

Q. Aside from all theoretical considerations, is it not a fact that the gas companies in nearly all the large cities in Europe have been compelled by the sanitary authorities to so modify their process of manufacturing as to prevent the dissemination of the offensive gases, which are still liberated by the Metropolitan Company from their fouled lime? A. My general reading of gas literature permits me to answer that, in large cities and densely-populated neighborhoods, they have.

Q. In other words, your answer is in the affirmative? A. It is in the affirmative, I believe, if I understand the question distinctly.

Q. Is the *American Gas-Light Journal* a recognized authority? A. It is the only authority in the shape of a journal in this country upon gas matters.

Q. In the number for February 16th, 1869, the article under the heading of the "War of the Purifications;" when did you first see that article? A. Is it necessary to be very precise about the time; I don't know that I can recollect it aright.

Q. Give it as precisely as you can? A. I think I saw it there on Wednesday or Thursday last.

Q. After its publication? A. That question I shall decline to answer; I do not think I am called upon to give the authorship of an article in a paper; it is attributed to the editor of the paper.

Q. Did you write the article? A. (*By advice of Judge Van Vorst.*) I wrote the article.

Q. Does it express your opinion? A. Well, so far as any opinion is expressed in it, it does.

Q. Does it state correctly your position? A. Not my individual position; it states the position of the journal.

Q. But it does not state your individual position? A. I did not feel called upon then, nor do I feel called upon now, to state my individual position in the case.

Redirect examination by *Judge Van Vorst:*

Q. Do I understand you to say, in answer to the question of Colonel Bliss, that in your opinion the Metropolitan Gas Company would do well to adopt the process of ventilation in use by the Manhattan Company? A. It would, in my opinion, be well for them to thoroughly examine into the process used by the Manhattan Company, and adopt it in some form of modification. I do not look upon it as a perfect thing by any means yet. No process is perfect; they might be able to improve upon it.

By *Mr. Bliss:*

Q. It is the most perfect you know of, is it not? A. It is, as I said in my examination.

Adjourned to Wednesday, February 24th, at one o'clock.

TESTIMONY OF OSCAR ZOLLICOFFER, PRESIDENT OF THE METROPOLITAN GAS-LIGHT COMPANY.

SATURDAY, *February* 27, 1869.

Oscar Zollicoffer, called for the Metropolitan Gas-Light Company, being duly sworn, testified as follows:

Examined by *Judge Van Vorst:*

Q. You are the President of the Metropolitan Gas-Light Company? A. Yes, sir.

Q. How long has that company been in operation? A. Five and a half years.

Q. What district do you light? A. From 34th to 79th streets, between North and East rivers.

Q. You used the lime process for the purification of gas? A. Yes, sir; at present dry lime.

Q. Was that process in use throughout the city when your company went into operation? A. There was none other than that; it is only lately that we knew of another process.

Q. What, if any, preparations or efforts have your company made to remove the effete lime after it has purified the gas—state what you have recently done on that subject? A. I have engaged boats, as I promised Dr. Chandler six months ago; when the material is placed on the boats, the hatches are closed without any delay, and then it is removed over to New Jersey, where we have engaged dumping-grounds.

Q. That is to say, as soon as the purifiers are opened, the lime is removed to those boats lying at your dock? A. Yes, sir.

Q. And the hatches are closed on the lime immediately? A. Yes, sir.

Q. And that you mean to continue? A. Yes, sir, until another method is found out for purification.

Q. Has your company any preference for the dry-lime process of purification, if there is a better process than that? A. Not in the least; I told Dr. Chandler that very thing; we want the very best, whether it is lime or oxide of iron; we want that which is the best for the purification of the gas, and at the same time which will retain its illuminating power.

Q. The object of the company is to obtain the best gas, and also to have the best illuminating power? A. Yes, sir, we would like to improve upon any method.

Q. Since this proceeding has been pending before the Board of Health, what have you done about ascertaining the process of purification in use in Europe? A. We sent out a special man that was recommended to us very highly, from two well-known chemists, to ascertain the different modes of purification in use there; he has just returned.

Q. What did you send him to Europe for? A. To ascertain the modes in use in England, in France, in Germany, to see what improvements could be made, and with the intention to immediately adopt that which, from the different reports he should make, should be the best, after its being submitted to the Board of Health, if acceptable to them; I proposed to Dr. Chandler, as soon as it is in operation, that he shall come and see it on the premises; if it had not been for the press of business, we could have had it in operation by the first of March; the spent lime is all going to be removed; it is now being removed, a large quantity being taken each day; there is no smell to that lime.

Q. You are having that removed all the time? A. Yes, sir; we want the room ourselves.

Q. You say that your time is engrossed, in extending your works? A. Yes, sir, in extending our works and making improvements and repairs, we occasionally need very much this year.

Q. Has there been any special pressure on your company this year? A. Yes, sir, particularly so; from the increase of the consumption of gas in the district; we must build more retorts and gas-holders this year.

Q. Your works have been tested to their utmost capacity? A. Yes, sir, to the utmost in December and January; to the utmost they could produce.

Q. What, if any steps, has the company taken lately, for the purpose of introducing any improved method for the purification of your gas? A. As I said before, we engaged a chemist, and sent him to Europe.

Q. Has your Board appointed a committee to introduce an improvement immediately? A. They have; they made me chairman, and appointed three members to take it particularly in charge.

Q. With instructions to introduce immediately some improved system of purification? A. Yes, sir.

Q. So as to avoid all offensiveness? A. Particularly to avoid all bad smell; I forgot to say we had a chemist who has been making experiments, and has several times destroyed the bad smell in small quantities of the effete lime, and he believes he can do it on a large scale.

Q. That is, remove the foul odors from the spent lime? A. Yes, sir.

Q. And you think those experiments you will be able to report on Monday? A. We will begin to work by it on a large scale, we think, on Monday and every day next week; the lime will be put into the liquid to destroy this smell; it is an experiment only, and I can't say it is perfect only on a small scale; next week all the spent lime is to be treated according to this new process.

Q. Which is the result of some recent experiments of this chemist you have spoken of? A. It is a wonderful success on a small scale; the sulphur is taken out and is crystallized.

Q. Is your company, in good faith, now engaged in the work of so purifying the gas as to get rid of all offensive odors? A. Yes, sir.

Q. Colonel Hastings is under the impression that you are pursuing the Fabian policy? A. No, sir.

Q. Your Board has no preference for your present system of purification over any better system? A. No, sir; on the contrary, I prefer the other one; I heard of it in Europe, and I told our engineers repeatedly that it was my view, and I am certainly in favor of it.

Q. You would be glad if the process of purification by oxide of iron should prove to be a good process, and if so, your company would have no objection to adopting it? A. No, sir, they would not have any objection.

Q. What should you think of adding a little lime to the oxide-of-iron purification? A. That is my impression; I am not competent to speak upon that subject, but I think it will be adopted again in English works.

Q. You think they will supplement the iron process with the lime? A. Yes, sir, with one larger.

Q. Would you think that would have any effect upon the candle-power of the gas? A. Chemists say so and our engineer; we have got a chemist who has discovered what I think will no doubt be an improvement; I can't give the name, as it might interfere with our arrangements.

Q. Have you ever seen this process which is in use by the Manhattan Company? A. Yes, sir; it is just the same as ours; I have seen the retort—exhauster—where it passes through; Dr. Chandler told me he was not satisfied with that, that it was only carrying it from one place to another.

Cross-examined by *Colonel Hastings:*

Q. Is there any other company in the city that is using the dry-lime process in the same manner as it is used by the Metropolitan Company? A. I think the Manhattan has recently adopted theirs—the ventilation.

Q. Do you not regard the process as used by your company as the most offensive of any now in use in this city? A. Allow me to say that I cannot say any thing of that kind; the odors arising from our gas-works in our neighborhood are not offensive; we have four blocks round from which no complaints have come; Dr. Stone told me that in two years only two complaints had been made.

Q. During the process of the purification of the effete lime at the Metropolitan Works, is not a strong and pervading stench produced? A. Immediately when you open the purifier, but not longer than for half an hour afterward.

Q. Does not that stench extend a great distance from the works? A. Not two blocks; we are different from the Manhattan Company, in that they do a large business, while we do a comparatively small business; I would like to have gentlemen come and see our works.

Q. Do you mean to say that the odors from this effete lime do not extend beyond two blocks? A. Except perhaps in very damp weather, for a day or two.

Q. How long have you known of the improvement now in use at the Manhattan Gas-Works? A. I should think about eighteen months.

Q. Do you know any reason why your company could not adopt a similar improvement? A. Because we do not think it is sufficient.

Q. Do you know any reason why your company could not adopt the same improvements? A. I think it is not quite sufficient. I don't think it would be satisfactory to the Board of Health.

Q. Do you know any reason aside from that why your company might not adopt it? A. Except that we are very crowded for room. It is a sliding ground there, and it is very difficult to make a high tower.

Q. Your company could obtain the room for that purpose? A. Far off; not near by.

Q. Do you know any reason why your company could not adopt the method of purification in use at the New York works? A. That is because it has not been proved a success. Mr. Adams, the president of the company, told me about three or four months ago, when I was there in August. He said, "Mr. Zollicoffer, do not adopt it. Every day the gas changes; one day it is good and one day it is poor. The gas is not uniform." You can examine him and he will tell you the same.

Q. When was this committee for introducing a change appointed? A. That was only at the last meeting—Wednesday of last week.

Q. Were they invested with full powers? A. Yes, sir.

Q. With full powers to make the improvements? A. Yes, sir.

Q. This is the first decided step taken by your company for the introduction of a change? A. No, sir; we have given you already what has been passed by the Board.

Q. But no committee was appointed? A. No, sir; it was left with the president and officers of the company at that time.

Q. And beyond sending an agent to Europe and the recent experiments you have spoken of, nothing has taken place with reference to a change since this investigation commenced? A. Have been all the time reading and studying.

Q. No other experiments? A. No; we hadn't the time to spare.

Q. When was this chemist employed to report on a better process? A. It was in September or October when he went to Europe.

Q. What is his name? A. Schussler; he resides in this city.

Q. You say that the process recommended by him is to be introduced at the works? A. No, sir; that is another one.

Q. When was the chemist employed, who is about to recommend a new process to your company? A. It is about three weeks ago first.

Q. Who is he? A. Mr. Milachon; it is a French name.

Q. The experiments made by him are with direct reference to deodorizing the effete lime? A. Yes, sir.

Q. Is the process upon which he is experimenting to be introduced into your works? A. If it proves to be good it will be. I will not introduce any thing permanently, except I first consult with Dr. Chandler.

Q. Have any number of experiments been made upon that process in your works? A. Yes, sir; several times last week.

Q. And those experiments are about to be extended? A. Yes, sir; this week largely—on Monday, if all the boxes are ready. We have to get all the apparatus made.

Q. Have boxes been ordered sufficient for the entire amount of effete lime? A. What is made fresh.

Q. Fresh effete lime? A. Yes, sir.

By *Judge Van Vorst:*

Q. As the boxes are emptied? A. One is emptied at a time every second day.

By *Colonel Hastings:*

Q. There is a considerable quantity of effete lime which has been removed from the Metropolitan purifiers now lying in an exposed state in this city? A. Yes, sir.

Q. There is over 100,000 bushels? A. I should say by this not much more, that is the spent, has no bad smell at all.

Q. During the process of removing the effete lime from the Metropolitan purifiers, as now conducted, is it not exposed to the surrounding air. A. Not more than five minutes—just the transportation to the boat.

Q. When did you adopt this improvement of shipping the lime? A. About five days ago the boats came up.

Q. To what point was it removed? A. Over to Bull's Ferry.

By *Judge Van Vorst:*

Q. Would you suggest the oxide-of-iron process supplementing that of lime? A. That is what I believed would be the result. We wish to give the best gas, and manufacture with the least offence to the public.

By *Colonel Hastings:*

Q. How much time is required for the transfer of the refuse lime from the purifying-boxes of the Metropolitan Works to the vessel? A. Five minutes.

Q. The entire contents? A. I should say two hours at the most—less than two hours.

RESOLUTIONS OF THE BOARD OF DIRECTORS OF THE METROPOLITAN GAS-LIGHT COMPANY.

Judge Van Vorst put in evidence the resolutions passed at the meeting of the Board of Directors of the Metropolitan Gas-Light Company, on the 24th of February, marked Exhibit D.

(Exhibit D.)

At a meeting of the Board of Directors of the Metropolitan Gas-Light Company, held at the city of New York, on the 24th day of February, 1869, the following resolutions were passed:

Resolved, That it is, and always was, the sense of this Board, that the process of the manufacture and purification of gas in use by this company should be such as to avoid all just ground of complaint on the part of the Board of Health, or of any citizen of New York, referring to a memorial presented by this Board to the Board of Health, August 17, 1868.

Resolved, That a committee of three members of this Board be appointed with authority and power to put in operation, as soon as can be done, a judicious system of purification, which shall be an improvement on the company's present method.

That, in carrying out this resolution, such committee are empowered to adopt such improved system of purification as will prove satisfactory, and to apply the same at the company's works as soon as it can be done.

Resolved, That, in considering such improvement, the committee be governed by the two principal objects, to give the best and purest quality of gas to consumers, and manufactured and purified in such manner, under the most recent and best methods, and so as to be attended with the least possible offence or annoyance to the public.

Resolved, That a copy of these resolutions be transmitted to the Board of Health.

Resolved, That Thomas T. Buckley, David H. McAlpin, and Robert H. Arkenburgh, constitute such committee.

Attest—WM. MEIKLEHAM, Secretary.

TESTIMONY OF JESSE LISSENDEN, AN ENGINEER AT THE MANHATTAN GAS-WORKS.

Jesse Lissenden, called by the Board of Health, being duly sworn, testified as follows.

Examined by *Colonel Hastings:*

Q. You are an engineer of the Manhattan Gas Company, of this city, are you not? A. At that company. Not of the company.

Q. Of the works? A. Yes, sir.

Q. How long have you been employed in that capacity? A. Nearly fifteen years.

Q. And during this time you have been familiar with the method of purifying gas—in use at the Manhattan Gas-Works? A. Yes, sir.

Q. What is the process used by the company you represent? A. I suppose it is called the dry-lime process.

Q. In what respect does it differ from the process employed at the Metropolitan Works? A. I don't know that it differs at all.

Q. Is the method of ventilating the refuse lime different from that in use at the Metropolitan Works? A. I don't know any thing about the Metropolitan Works.

Q. What is your method of ventilating the effete lime? A. By oxidizing the foul gas that remains in the lime after the purification.

Q. State how this is done. A. The cover is first raised from the box and shifted one side.

Q. From the purifying-box? A. Yes, sir. Then the exhauster is applied underneath the bottom of the box for two hours. The exhauster runs, I think, about 800 revolutions a minute.

Q. Runs by steam? A. Runs by steam, yes, sir. After that, the men go to work and take out the first tier of plates, which makes an opening right to the bottom of the box, on each side, that allows the air to go down underneath, giving free vent right through. After it has worked in that way for one hour it is closed off. We then run the exhauster another hour with an opening in the engine-room sufficient to let the fresh air go through the engine-room, through the deodorizer, and out of the chimney where all the foul gas escapes. This is supposed to put out all that is not taken out by the deodorizer.

Q. The gas that remains? A. Yes, sir; after three purifiers have been applied, the material in the deodorizer is changed. We never put more than three through it, without supplying it with fresh material.

Q. After the effete lime has been through the process you have described, is it inodorous? A. I can't say.

Q. What is your opinion? Is it offensive to smell? A. I should think not; no, sir. I could not say positively, for I have never taken particular pains to smell of it. Of course it can't be expected that it will be made as pure as pure air by any process that can be devised.

Q. Why was this change you have spoken of introduced? A. Because there were so many complaints around.

Q. Do you find in practice the improvements you have described successful? A. I believe it gives general satisfaction.

Q. Does it meet the end for which it was designed? A. I think it does.

Q. Since its adoption, have there been any complaints in regard to the offensiveness of the refuse lime at your works? A. Well, sir, I have heard some of the bosses complain of it in the works. The men sometimes say that something is not working right.

By *Judge Van Vorst:*

Q. Complain of a bad smell? A. They say so.

By *Colonel Hastings:*

Q. Have there been any complaints from the neighborhood in regard to the offensiveness of the foul lime since the adoption of this improvement? A. I don't know that there have; not that I remember.

Q. The only complaints that have reached your knowledge are from the employees in the works? A. Yes, sir. There are various causes, you know, for their finding fault with the smell since the adoption of this new improvement. For instance, if the exhauster, instead of running 800 revolutions, is run no more than 400, or 500, you could not expect it to produce the same result as when it runs 800; but, if the belt slips, we have to stop and take it up. Probably we may run on one purifier only before we detect that the belt has slipped and the exhauster is not making the revolutions that it should do. Then, of course, there would not be the amount of suction on that purifier, and the smell would probably be a little bad.

Q. During the process of deodorization, as conducted at your works, can offensive gases or odors be detected outside the works? A. Yes, sir, but very seldom. As this gentleman before me stated, in foggy weather, you may find a little smell.

Q. In works now using the dry-lime process, what changes would be necessary to introduce the improvement used by the Manhattan Company? A. I don't know. State that again.

Q. In works now using the dry-lime process, as ordinarily conducted, what changes would be necessary to introduce the improvement used by the Manhattan Company? A. They would need to have a suction-pipe attached to every box in the house—the bottom of it—and then they would need to have an exhauster as we have, and then they want another box in a small building by itself, and a chimney connecting with this box.

Q. Do these changes involve any interruption in the manufacture of gas? A. They need not do so.

Q. Is any additional room required for the use of this improvement? A. Oh yes.

Q. How much? A. The exhauster would take five or six feet square.

Q. Is that all the additional room required? A. That is all that part would require.

Q. Then there is the steam-engine. What further room would that require? A. It requires ground enough to build the house for a deodorizer and chimney.

Q. About how much? A. I suppose that building, as near as I can guess, is 20 feet square, or probably more. It might be 25; I could not say positively. Then the chimney, which is 60 feet high, that would require some space.

Q. Do you regard the introduction of this improvement by any company, using the dry-lime process, as entirely practicable? A. Yes, sir, if they have got the space to put the machinery, and the chimney, and the house on. I forgot to tell you that there is another article attached to that deodorizer—a water concern. That is a new thing which has been put in there within, I can't tell you positively how long a time, but I should think inside of fifteen months.

Q. Scrubber? A. A kind of washer—something of that kind. I have not seen it. I have been told it was there.

Cross-examined by *Judge Van Vorst:*

Q. About how long would it take to make all these erections? You speak of the chimney; putting up the engine. About how long? A. You have become too tight upon me.

Q. How long would it take your company to do it? A. I could not say.

Q. Could you say about how long? A. No, sir; I could not come within three or four months of it. I would not like to say any thing about it.

Q. Do you think engines could be ordered and all those buildings be put up within three or four months? A. Provided they had men enough.

Q. It could be done? A. It could be done in four months, I think.

Q. All these improvements made? A. Every thing.

Q. I want to ask you this question—whether there is any part of your improvement in use by the Manhattan Company, for ventilating the effete lime, or the deodorization of it, which is subject to a patent? A. Yes, sir.

Q. Who owns the patent? A. The architect of our works. His name is Farmer.

Q. You say that there is some unpleasant smell about the works? A. Occasionally.

Q. Do you know of any method of the manufacture or ventilation of gas, except there would be some smell about it? A. I do not.

Q. The object of your company has been so to purify it as to have the least possible smell? A. Yes, sir.

Q. When this system of ventilation you spoke about is in use, there is on some occasions an unpleasant smell? A. Yes, sir.

Q. Especially as I understand you to say when the air is moist and heavy it drives the odors which come out of that chimney down to the earth? A. I suppose so.

Q. And at times the bosses about your establishment have complained of smells—about smells? A. Yes, sir.

By *Colonel Hastings:*

Q. You say Mr. Farmer has a patent? A. Mr. Farmer has a patent on the exhauster.

Q. The method of purification is the same in use as at the Metropolitan Company, except in the matter of ventilation? A. I suppose so, I have not been there.

Q. The only difference is the supplementary process of ventilating of the effete lime? A. Yes, sir.

Q. Your company has not the exclusive right to use any portion of the machinery you describe? A. Not that I know of.

By *Judge Van Vorst:*

Q. Do you think they have not? A. I know there has been one manufactured and put up outside of our works in the city. I think it was for a different purpose—for blowing fires.

Q. The question which Colonel Hastings asked you, and which I should like to have you answer, was this: Whether the patent is owned by the Manhattan Company? A. It is owned by this man, Farmer. The company have nothing to do with it that I know of.

Q. Do you know what other companies in this city use the dry-lime process, except the Metropolitan and the Manhattan. How does the Harlem purify? A. I don't know.

By *Colonel Hastings:*

Q. Are you familiar with the oxide-of-iron process? A. I am not.

Q. So far as you know, your company is perfectly willing that other companies should adopt the improved system of ventilating lime? A. So far as I know.

TESTIMONY OF PETER CARTWRIGHT, AN ENGINEER AT THE NEW YORK GAS-LIGHT COMPANY'S WORKS.

Peter Cartwright, called by the Board of Health, being duly sworn, testified as follows:

Examined by *Colonel Hastings.*

Q. Are you in the employ of the New York Gas Company? A. I am.

Q. In what capacity? A. As practical engineer.

Q. How long have you been so employed? A. For twenty years.

Q. What process of purifying gas is in use by that company? A. The iron process.

Q. State in what form the iron is used in that process? A. The iron-ore we get from Staten Island, and with it is placed a percentage of iron borings and turnings, and we mix the mass with ammoniacal liquor to oxidize and prepare it for use.

Q. How long has this process been used in your company? A. Ten months.

Q. What process was in use by your company previous to this process? A. Dry lime.

Q. What changes were necessary in the introduction of the present process? A. Well, very little changes indeed—introducing new bottom, with skids of wood.

Q. New bottoms to the purifying-boxes? A. Yes, sir; that is the superficial bottom to receive the iron oxide.

Q. How much time would be required to make this change in any gas-works using the dry-lime process? A. About five hours, in the putting in the new bottom, and be ready to turn on again when the lime was fouled. That is the way we turned on ours.

Q. If a gas company using the dry-lime process had a double set of purifiers, would this change to the iron process involve any interruption in the manufacture of gas? A. Not at all; with only one set it would not.

Q. How does the iron process as used by your company compare with the dry-lime process in respect to offensiveness? A. Our house is now like a bed of roses to what it was when we used lime.

Q. Your company found the dry lime very offensive? A. Yes, sir; very, indeed.

Q. And was it that cause that led them to the adoption of the iron process? A. It was, and to comply with the law.

Q. Is the iron process used by your company practically inoffensive? A. There is no offensiveness whatever about it.

Q. Does the gas manufactured by your company suffer in illuminating power in the use of this method? A. I don't know, to my knowledge. Some say it does, and some say it does not.

Q. Do you know how your company regard the iron process; whether as a success or a failure? A. They consider it a success.

Q. Do you know whether they have any intention of modifying or changing the process they now use? A. I do not.

Q. How does the process used by your company compare with the dry-lime process in respect to expensiveness? A. There is great economy in the iron process. I think it will save our company this year $13,000 in lime alone—material alone. The labor is not so much, because of the offensiveness of the lime in winter, when we were making our greatest consumption. We had to employ a double set of men sometimes, and men would be knocked over, and then we would have to employ men in their places and pay them, too. I have picked them up and carried them out myself.

Q. When you were using the dry-lime process? A. Yes, sir.

Q. Knocked down by what? A. The offensive smell.

Q. How many instances of this character do you recollect? A. I could not tell how many, there have been so many. I have picked them up myself and carried them out. One day the lime-man was bringing in a load of lime, and the man was going over when our men caught him, or else he would have gone over and the horse and cart would have gone on to him. The horse fell down, and we had to take him out of the harness and take him out in a lot.

Q. Men and horses were afflicted in the way you describe, when the lime was being removed from the purifying-boxes? A. We had broken into them then for ventilation, and the fumes starting out of the house met them. We had to let them stand for four or five hours before we could get the lime out.

Q. Is any additional room required for the use of the iron process? No; we made no additional room. It would be better with additional room, certainly, or else in a shed or out-building.

Q. Can the oxide of iron be revivified in the open air, or do you require a building for that purpose? A. It can be revivified in the open air, but it is better if you could protect it in storms. Of course it is better if it is protected from the weather.

Q. Is any odor given off from this iron mixture during the process of revivification? A. Not at all.

Cross-examined by *Judge Van Vorst:*

Q. How long has this process of purification by your company been used? A. For ten months.

Q. Before that, you used dry lime? A. We did.

Q. How long have you been an engineer there? A. Twenty years.

Q. And were you an engineer during the time they used dry lime? A. I was.

Q. Is any of the process of this purification by the oxide of iron patented? Have you got a patent for it? A. We have.

Q. From whom did you get the patent? A. From the parties at Washington.

Q. Who owns the patent? A. Me, for one.

Q. Do your company? A. Me, for one.

Q. You are interested in the patent? A. I am.

Q. And you think well of that process? A. Yes, sir.

Q. There is no smell of gas from the fouled iron? A. There is not.

Q. It is pleasant, on the other hand? A. Yes, sir, I think so.

Q. Does it deliver as pure gas as the gas purified by the lime process? A. I don't know of my own knowledge.

Q. Does it take out the carbonic acid? A. In a great measure, it does. In a small measure, it might not.

Q. Does the presence of carbonic acid increase or diminish the candle-power? A. I should think it diminishes it a little.

Q. Then the gas delivered purified by the oxide of iron has not so great an illuminating power as that which is purified by the lime process? A. I think it would if the lime and the iron process was carried the same distance. I think the iron process would retain its luminosity for a greater distance than the lime process.

Q. Do you mean to say that? A. I do.

Q. I ask you this question: Does the iron process take out all the carbonic acid? A. No, sir.

Q. Therefore, it does not purify quite so well as the lime in that respect? A. No.

Q. In respect to taking out carbonic acid, the iron process does not take it out as well as the dry lime? A. It does not.

Q. In order to get this right to purify with the oxide of iron we must get the right from you, must we not? A. For what?

Q. We must obtain the right to use it from your patent? A. Certainly.

Q. From you? A. Certainly.

Q. You say you never heard any complaint made about bad smells since the oxide of was used there from anybody? A. From anybody.

Q. Have you heard no complaint about the gas delivered? A. I have seen it in the press.

Q. What have you seen in the press about it? A. Why, saying that the gas burned blue, etc.

Q. That the gas burned blue, etc.? A. Yes, sir; I did not see that, but I saw the words of Prof. Wurtz here, who made use of those words. I did not see it in the press myself before that.

Q. Haven't you heard complaints made of that gas, that its candle-power was diminished? A. I have.

Q. You have heard those complaints? A. I have.

Q. That the candle-power of the gas purified by the oxide of iron was diminished? A. I have heard so.

Q. Repeatedly? A. Yes, sir.

Q. From consumers? A. Never. Not a word from consumers.

Q. From whom? A. From opponents of the oxide-of-iron process.

Q. From those who were opposed to the purification by the oxide-of-iron process you have heard that the candle-power was diminished. A. Yes, sir.

Q. Don't you yourself think it is diminished a little? A. I do not.

Q. Don't you think the candle-power is diminished some? A. I do not.

Q. Not at all? A. I do not.

Q. Not in the least degree? A. I do not, to my knowledge.

Q. After the iron is taken out of the purifiers, what do you do with the foul oxide of iron? A. Throw it out on the floor.

Q. For what purpose? A. To oxidize it.

Q. Is there nothing given out; are there no emanations proceeding from it? A. No smell.

Q. Are there no emanations proceeding from it? A. Yes, sir.

Q. There must be some emanations? A. Yes, sir; there is a vapor rises from it when in the state of oxidation.

Q. There must be room of course to have this iron after you have taken it out of the purifiers, to ventilate it? A. Certainly, must have room, of course.

Q. Do you know how the Harlem Company purifies its gas? A. I do not, from my own knowledge; I heard that they purified with lime, that is all I know about it.

Q. Dry lime? A. I have heard so.

Q. Have they got any ventilator? A. I don't know.

Q. Are you taking measures to introduce your patent throughout the country—this process of purifying gas by iron? A. Will serve anybody who will take it.

Q. Are you or are you not taking measures to introduce it? A. We are not.

Q. You are doing nothing about it? A. We never apply to anybody, or to Mr. Zollicoffer, nor any other parties around New York.

Q. Have you advertised it? A. We have.

Q. You are doing it now? A. We are not.

Q. You have advertised it lately, have you not? A. I should think not for four or five months.

Q. You have advertised the sale of the right to use it? A. Certainly.

Q. And you are doing it now? A. Yes, sir.

Q. To any person who wishes to buy it? A. Yes, sir.

Redirect examination by *Colonel Hastings:*

Q. How came you to make the invention spoken of? A. We tried to comply with the law and to destroy the offensive odors around the works.

Q. You were making experiments to that end? A. Yes, sir.

Q. Relating to the removal of the offensiveness by the old process? A. Yes, sir.

Q. Under what auspices were you making such experiments; under whose directions or request were you making those experiments? A. The request of the president of the Company.

Q. Of the New York Company? A. Yes, sir, Mr. Adam.

Q. Were those experiments satisfactory to the Company? A. They were glad to get hold of it.

Q. And for that reason the process was introduced in the New York Works? A. Yes, sir.

Q. By whose advice, if any, did you obtain a patent upon the process? A. No one's advice; only we advised each other; two of us were associated, William H. St. John, and Peter Cartwright.

Q. You obtained a patent, I suppose, because you required it, as a valuable improvement and a success? A. Yes, sir.

Q. Has the New York Company any interest in the patent? A. Not a cent.

TESTIMONY OF ELISHA HARRIS, M. D., SANITARY SUPERINTENDENT OF THE METROPOLITAN DISTRICT.

Elisha Harris, M. D., being called for the Board of Health, being duly sworn, testified as follows.

Examined by *Colonel Hastings:*

Q. State, if you please, your profession and residence. A. I am a physician and reside in West 42d Street.

Q. How long have you been in that profession? A. For the last twenty years, sir.

Q. And in what professional relation are you at present employed? A. Sanitary Superintendent of the Metropolitan District.

Q. Have you read most of the testimony adduced in the hearing under the order relating to the Metropolitan Gas Company? A. I have read about two-thirds of all the testimony that was given prior to your sitting to-day, from the first.

Q. In addition to the examination of the evidence referred to, have you given the subject of the best method of purifying gas any study or attention? A. Only so far as connected with the questions of sanitary improvement in cities, where these questions have been already examined, and in connection with the progress of chemical knowledge, as these questions illustrated some of the leading facts in the chemistry of gases.

Q. Do you know what gases, if any, are given out from the foul lime removed from the purifying-boxes of any company using the dry-lime process? A. The gases which are given out in such a manner as to be the object of special examination and remark by sanitary officers and physicians are mainly the sulphuretted gases and undefined and unestimated amounts of the compounds of cyanogen, but chiefly the sulphuretted gases, the sulphide of ammonium being evolved after a time when the fouled lime is exposed to the atmosphere.

Q. Are any of the gases escaping from such fouled lime recognized by sanitarians as injurious to life or detrimental to health? A. Yes, sir; all the compounds or complex sulphur gases, except sulphurous acid in vapor, which is not to be mentioned as a gas, are recognized as directly injurious to health, the sulphide of ammonium being the most poisonous of the sulphur gases which are known to sanitary science; the experiments with these different gases being too incomplete to enable us to compare them relatively, we can speak of the sulphuretted hydrogen and the sulphide of ammonium as being chiefly the obnoxious gases evolved from the foul lime when exposed to the atmosphere.

Q. What evidence is there that sulphuretted hydrogen gas is dangerous to health? A. First, the large number of accidents from respiring the gas have abundantly proved that it is fatal to life when it exists in a certain percentage in the common atmosphere, or in the atmosphere of any room or place; then a great variety of experiments with small animals which have been very decisive in their character; and thirdly, observations upon persons who are compelled, from their vocations or by any accident, to breathe sulphuretted hydrogen for any considerable period day after day in their vocations; all these go to prove the same thing, that the sulphuretted hydrogen is injurious to health, and the experiments prove that a small percentage will destroy life; a percentage, however, of one per cent. does not necessarlly destroy life, but whenever the percentage has been increased from point to point, in the scale, the various animals that have been subjected to it have been killed. The list of experiments given in this volume which I have in my hand—

Q. What volume is that? A. This is Hammond's Hygiene.

Q. Is it a standard work? A. Yes, sir; this is a brief list; and, if you desire, a more complete list of experiments could be presented immediately, but this briefly shows about how the case stands. I will read from page 156: "Sulphuretted hydrogen is exceedingly poisonous. Dupuy *père* found that 1-800th of this gas was sufficient to render the atmosphere so poisonous that small birds were killed in a few seconds when subjected to its influence. One part in 299 parts of atmospheric air proved fatal to a dog. Chaussier found that one part in 250 of air sufficed to kill a horse."

Hammond further says: "The results of my own experiments with sulphuretted hydrogen do not differ materially from those of other observers. I found with Dupuytren, that all small animals, as birds and mice, were killed by a smaller proportion of gas in the atmosphere in which they were confined, than larger animals. Sparrows and mice did very well in an atmosphere 1-1000th of which was sulphuretted hydrogen. With more than this death ensued, though not until twenty or thirty minutes had elapsed." These were carefully made by Dr. H., who is a distinguished physiological experimenter. He continues: "On a *post-mortem* examination the blood was found perfectly dissolved, and the blood-corpuscles completely broken down. The action of sulphuretted hydrogen, when not inhaled in a large quantity, appears to be that of a narcotic poison. Its effects upon the organism, when its action is long continued in a small amount, has not been so thoroughly investigated as is desirable. That it is capable of producing injurious results is very certain. * * * * Dr. Taylor, the author of a work on medical jurisprudence, refers to instances which occurred as to the poisoning by this gas of workmen engaged in excavating the Thames Tunnel, by respiring the atmosphere of this place. The strongest fellows were in a few minutes rendered extremely weak, and several died."

All the evidence regarding the operation of the poison upon the blood being so very important, that sanitary officers have felt it necessary to ask for special experiments. A series of experiments on a large plan have been in progress for two years under the Health department of the Privy Council of Great Britain upon this and various allied subjects, and some of the results of these experiments have also been published, much more conclusive than these older and more general experiments.

Q. Well, do the conclusions established by those experiments all tend to the same end? A. They all show that these sulphuretted gases destroyed the blood-corpuscles, which have always been recognized as constituting the most essential element in the whole range of the physiological constitution of the living body. To know just what kind of changes occur in the blood, while circulating under and exposed to the influence of these gases, has been one of the nicest and most exact kinds of chemical inquiry that have ever been pursued.

Q. What other gases escaping from fouled gas-lime would you consider obnoxious to health? A. The sulphide of ammonium is the asphyxiating gas of all others, which is recognized as being the most quickly destructive to life, and it is combined in the gases which float off from the fouled lime, so that no ordinary observation, I suppose, could state which was in excess, but the special odor of sulphide of ammonium is far the most offensive. That is the gas that usually so quickly destroys life in persons who chance to go down into deep privy-vaults, as scavengers, and that class of persons who have suddenly died on going into privy-vaults—accidents that have actually occurred in this city, and which are recurring all over the world among scavengers.

Q. As a sanitarian, will you state what is your opinion as to the danger to the public health from the presence of the fouled gas-lime within the limits of the city of New York? A. If gas-lime is exposed to the atmosphere it will give off these deadly gases, and the sulphide of ammonium with certainty coming that is derived from the sulphide of calcium, which exists always in abundance in the fouled lime, and it will float in the common atmosphere until such transformations have occurred as destroy its character, as sulphide of ammonium will float in the direction in which the wind is blowing, which is a fact well certified to by experiments, and in particular states of the atmosphere as regards temperature and barometrical pressure it may float far over the city—so far as to become dangerous to health to a great distance. Again, the gas itself is judged to be more obnoxious at the distance of a few blocks from the mass of lime from which it is evolved, than it is immediately on the premises. My own observation fully confirms that as regards the effort to discover the localities within which this gas can be recognized by its odor, and effect upon the respiration. I have smelled it as far eastward as the top of Murray Hill on Madison Square, and as far southward as 14th Street, and frequently in West 42d Street, where I reside.

Q. Have you ever been able to trace these odors to their source? A. Yes, sir; I was able to trace these odors without being at the time able to gain access to the fouled pile of lime, some years ago, when the dry-lime method was used in the works on the east side of the city. I do not think that to be a demonstration which would answer any positive purpose of a public statement, but to me it was entirely conclusive. Following merely the odor, and noticing the direction of the wind at the time.

Q. To what distance did you then follow the odor? A. I then resided one door north of the Rev. Dr. Bellows's church.

Q. On what street? A. Between 20th and 21st Streets. I should think it must be a mile to the gas-works, perhaps three-quarters of a mile to the nearest gas-works, and I then made observations which satisfied me that the 14th Street works gave off the nuisance quite as abundantly as those that were near to my residence; and more recently, and last summer, when peculiar circumstances rendered it easy to follow any particular odor, from changes that had occurred in the atmosphere, making it peculiarly pure, and reducing the temperature by the change of the direction of the winds on the 5th day of July—I deemed it a duty to follow this kind of evidence up to its source, and asked one of the Sanitary Commissioners to join me, and in that case I was able to follow the odor directly to its source in the Metropolitan Gas-Works.

Q. From what point to what point? A. I observed the odor first at about 30th street, while walking up Broadway. On reaching my house in West 34th Street, between 5th and 6th Avenues, the odor was so oppressive in 34th Street, that I endeavored to follow from that point, and following from 34th Street, I went with the Sanitary Commissioner, who joined me for the purpose, to the lime-heaps, which were then freshly covered with the foul lime that had been thrown out. This observation was made for the purpose of satisfying our judgment on the precise source of a particular odor, and to see it with our eyes. There was then no intention of making it the ground of special complaint, because other companies in the city were known to be using the dry-lime process of purification, but here was an opportunity to settle unequivocally a fact which was important to know.

Q. You found the source at that time to be the heaps of fouled lime of the Metropolitan Gas-Works? A. Yes, sir, unequivocally.

Cross-examined by *Judge Van Vorst:*

Q. Have you given the subject of the purification of gas practically any attention? A. I have given it only that kind of attention practically which a person interested in sanitary knowledge must give if he would understand the source of impurity in the atmosphere, and the merits of questions which have become important in all great cities where gas manufacturers are located in the midst of the population. These questions are important in all the great cities of the world at present.

Q. You have given some attention to the subject of the merits of the respective methods of purification in use, theoretically, have you not? A. Yes, sir.

Q. Now, doctor, as the result of your own investigations, which is the better purifier of the gas—which eliminates from the gas the most foulness—the oxide-of-iron or the dry-lime method of purification? A. Neither process perfectly purifies the gas from what you technically denominate impurities?

Q. I ask you which of those two processes is the better purifier. I am not asking you whether any process does perfectly, but which of those two processes is the better purifier. A. I will answer your question directly and categorically as you put it, if you allow me to refer to substances instead of processes. For, as regards these two elements—natural elements—they are things and not processes. If taken alone, either process would be objectionable, but if I am to answer that question as relates to these things, I would say positively that lime will remove the largest amount of certain impurities, and hold those impurities ready to yield up again in another poisonous form, and iron will remove positively the same impurities, but not all of the same—the worst of the same—and will fix those impurities, and not yield them up in a poisonous form. So that, regarding them as processes, there is first that difference to be stated and that fact to be stated. Then we have to commence anew with the fact how to proceed to finish the task of purification.

Q. Could you suggest any improvement upon the process, or method, or thing, or whatever you call it, in use at the New York Company for the purification of its gas? A. I have not seen the New York process; I know those only by name.

Q. The oxide-of-iron process, which is the only process in this city covered by a patent; could you suggest any improvements in addition to the use of the oxide of iron as it is used there? A. I have not seen that, though I have been invited; I have been unable give any attention to either process, and, in my judgment, the oxide-of-iron process, as used there, has gradually diminished the offensiveness which people usually complain of in the neighborhood of gas-works, but I don't know the extent of the completeness in the purification of the gas itself.

Q. But the gas itself, as delivered to its consumers, is not as thoroughly purified of sulphurous compounds as that which would be delivered by the lime process; do you think so, speaking chemically and theoretically? A. There must be used, in addition to the iron process, however that is used, some alkaline earth, or substance, or fluid, that will receive and recombine certain impurities which the iron does not fully control.

Q. How would you suggest a little of the hydrate of lime as a supplement to it? A. That is found, by experience, to finish the job well.

Q. If the hydrate of lime in a moist form is used and not over-used, the quality of the gas that is burned is of the very highest that is known among gas manufacturers? A. Such is the testimony of hygienists who have examined it, and no offensiveness is caused among the community in which the gas is made; but the hydrate of lime must be used after the iron process, or you will have the offensiveness, because the iron is used merely to fix certain things which are very difficult to control, viz., these sulphur compounds which go to form the sulphide of calcium, etc., in the lime process, but then here is the carbonic-acid gas which must be controlled in order to give the quality that is needed to the gas; there is a residuum of sulphur which needs to be withdrawn if possible; the experiment of withdrawing it by secondary purification, I believe, has resulted triumphantly in several instances.

Q. In order to put this thing in a practical form, oxide of iron does not thoroughly remove the carbonic acid, and there is still in the gas a residuum of sulphur, so I understand you to say? A. Certainly, sir.

Q. And which, if it was subject to a supplementary or subsequent process of purification by the hydrate of lime, you think it would remove that carbonic acid and the residuum of sulphur the iron had failed to take out? A. The supplementary process with lime properly presented to the gas for this second purification, is said to be entirely triumphant, and the gentlemen who have certified it have undertaken the inquiry so intelligently and so conscientiously for hygienic purposes, that I would like to present it as an item of evidence.

Q. I would like to ask this question, whether there is any danger by subjecting the gas to this subsequent action of the hydrate of lime, after the iron has acted upon it, of enfeebling the illuminating power of the gas? A. Of course there would be, unless the chemist was master of the situation and knew his trade.

Q. What effect does the presence of carbonic acid in the gas, which the oxide of iron fails to eliminate, have upon the illuminating power of the gas when combustion takes place generally? A. I must say that practically I could not answer that question, and I merely state it upon the authority of chemists. It is not necessary that I should commit to paper any of the evidence, as it would not be original. It is but a small item, and imperfect as my own chemical knowledge might be, I would undertake to get out the carbonic-acid gas without damaging the gas.

Q. Don't chemical writers say that the presence of carbonic acid in the gas, when combustion takes place, diminishes its candle-power; don't writers upon chemistry say that? A. They do, and display weakness on the spot when they say it, unless they show how that carbonic-acid gas can be withdrawn.

Q. You have suggested a way to get rid of that by the use of hydrate of lime supplementary; I call your attention to a process where the hydrate of lime is not used at all subsequently? A. I have answered the question.

By *Colonel Hastings:*

Q. Do you know of any authority recognized as such among sanitarians that discusses the question of these poisonous gases escaping from foul gas-lime upon the blood or health? A. I do.

Q. What? A. As I stated in the opening evidence upon the medical question, the blood does suffer directly when exposed to these gases. I wish now to state that sanitarians have undertaken to find how it suffers, and whether such poisons can be resisted, because it is essential when studying the causes of diseases to find out what are inevitable poisons acting on the blood, and it turns out rather unexpectedly to some medical inquirers that there are gases which are in a very absolute sense poisonous. The carbonic-acid gas has long since been found to be only contingently poisonous. It destroys life; but it was not the poison which could always be asserted as the source of particular conditions of ill health which were discovered in foul places. What were the other gases was the question, and what kind of gases: and in this inquiry which is now in progress, and probably will be for several years by the Medical Department of the Privy Council of Great Britain, which is the last report of the second instalment of the chemical evidence on this very subject of the effect of certain exhalation, vapors, and gases upon the blood, on the subject of physiological and pathological questions connected with these chemical and natural forces—this item of evidence occurs bearing directly upon the question you ask. The essential element of the blood-corpuscles, which is most prominent and unyielding to all other effects which disease produces, is the hematocrystalline that enters into the constitution of every blood-globule, and constitutes a large percentage of it. In that hematocrystalline is combined all the iron that floats in the blood. The hematocrystalline has become the subject of most careful study, with reference to the changes gases produce therein. Now it is found that carbonic-acid gas does not at once destroy hematocrystalline. It is found that most of the poisons that are introduced into the body will break up the blood-globules and still leave hematocrystalline to crystallize as hematoidine. We have had occasion to study the hematoidine in the investigation of last summer, and the history of its persistent life as an element in the fluids, even of sick animals, is an interesting fact. But certain gases act upon that hematocrystalline and eliminate it so that it cannot be constructed into any of the forms of life in the animal tissues. That destruction of a very persistent and important element therefore of the body comes to be a specially important fact in hygiene, for we have been hunting for years for methods of exact demonstration of hygenic questions, and now it is done at the expense of the Lords of the Privy Council in the class of studies on a large scale. I will read from the Tenth Report of the Medical Officer of the Privy Council, London, 1858, at page 170: "A diminution of hematocrystalline in the body costitutes the disease termed chlorosis or anæmia. It is either a specific element or a symptom and consequence of chronic disorders, or particularly tropical fevers. * * * The hematocrystalline is the last ingredient of the blood which undergoes putrefaction. Its stability is the main factor in the stability of life. This quality is perhaps mainly the result of the power which it possesses of taking up oxygen from the air, and yielding it again to other matter in contact. * * * * Hematocrystalline combines readily and more pertinaciously than with oxygen, with a number of these gases, such as carbonic oxide, sulphuretted and phosphuretted hydrogen. * * * * The hematocrystalline is the last ingredient of the blood which undergoes putrefaction. It preserves its color and spectrum for years, in a horrible offensive mixture."

Q. That kind of evidence has this value in answering this question which has just been asked—that it is reducing to demonstration what hitherto had been stated in the way of assertion? A. It is showing how a change occurs, and, in order to show how the highest resources of chemistry are brought into play, namely, spectrum analysis, and show the beginning and progress and ending of certain changes which occur when the blood is exposed to certain poisonous gases; and the result of this inquiry shows that certain gases and these complex sulphuretted gases, and the phosphuretted gases, and a large number of others, and compounds of cyanogen gas come into the same list, instead of merely dissolving and breaking up the blood-globules, actually destroy the chemical constituent which in most diseases fails to get destroyed; so that the sanitary fact begins to be settled as a demonstration that certain gases should not be permitted to be evolved in a great quantity into the atmosphere which people breathe. Not that the people will be immediately killed, but that their health will be silently and persistently injured from a cause which no science before had perfectly controlled. Now, chemistry comes in with its exact methods of demonstration, but not until these higher applications of it by the beautiful method of the spectrum analysis had enabled us to get down to the one thousandth part of a grain, and study it with the interest with which we could formerly study larger quantities.

By *Judge Van Vorst:*

Q. The effect, I suppose, would be the same if these poisonous gases were evolved in the dwelling-houses where combustion of the gas takes place? A. Oh, yes; it makes no difference where the gases come from if they are only there when people are respiring.

Q. If those foul, poisonous gases are not eliminated in the act of purification, they do appear in the dwellings when the combustion of the gas takes place? A. No, sir, they do not in any perceptible quantity, for even sulphur appears as sulphurous acid.

Q. Isn't that poisonous? A. Sulphurous acid is a poison only contingently. It does not even destroy the blood-corpuscles, as it is presented to us in our respiration. It partakes of none of the qualities which I have described concerning the truly poisonous gases.

Q. Does it depreciate property? A. I have no doubt of that, because it will tarnish silver. That is not a sanitary question, however; it does not concern hygienists.

Q. Which do you suppose to be the worse, free sulphuretted hydrogen, or sulphide of ammonium free? A. Sulphide of ammonium, far worse.

Q. Have you ever heard of any person being killed by sulphide of ammonium? A. I have known of cases, and they are very numerous; they are known in common life as suffocation and asphyxia.

Q. Occurring under what circumstances? A. Occurring generally in old privies and similar situations; but there are cases which can be referred to as having occurred in a specific manner in gas-works. I need not adduce cases, because they are abundantly verified.

Q. Can there be any sulphuretted hydrogen at all given off by the waste lime, if the prominent odor on opening the purifiers is that of ammonia? A. Yes, sir; I have been present when gas-purifiers were opened and the predominating odor is sulphurous, and the ammonia is dissipated as the men are taking away the lime; and the lime, which I have myself handled twelve hours after it had been thrown out, has grown hot on exposure to the ordinary current of air. One week ago to-day I made the experiment, and the sulphide of ammonium was eliminated in a very offensive and considerable volume, and I was told that the lime had laid nearly twelve hours where it was in a mass; but there was no odor of ammonia there then, but, had I been present at the opening, there would have been an odor of ammonia perceived.

Q. And the odor would have predominated? A. I suppose it would, so far as my senses were concerned; it is one of the most pungent of gases to the senses; it naturally would be predominant.

Q. Notwithstanding all that, and conceding that the predominating odor is that of ammonia, you do think that there may be sulphuretted hydrogen given off by the waste lime? A. I think so; but I have not made exact tests of that question. I believe it is a fact conceded that it is given off.

(No further testimony offered.)

The hearing terminated here, as the Gas-Light Company promised to make the changes necessary to prevent the nuisance complained of.

An iron mixture was used during the summer of 1869, in one set of purifiers; but in the autumn, when the consumption of gas increased, it was thrown out and replaced by lime.

In November the Board ordered the chemist to report *in extenso* on the operations of all the New York Gas Companies. The report will be found on page 458.

When it appeared that the Metropolitan Gas-Light Company was still employing the old process of purification, it was cited to appear by its officers to show cause why the original order of July 14, 1868, should not be enforced. On February 2, 1870, at the earnest request of the officers and counsel of the company, a further respite of three weeks was granted to enable them to introduce the Laming process. On February 23, 1870, the chemist to the Board reported that Laming's process had been introduced, and that it not only gave entire satisfaction to the officers of the company as a purifying process, and made it possible to purify all the gas made with one set of boxes, two sets having been used for the lime process, but that, as far as he had had an opportunity to observe, it entirely removed the liability to the nuisance which had been so long a cause of complaint against the Metropolitan Gas-Light Company.

REPORT ON POISONOUS COSMETICS.

Colonel Emmons Clark, *Secretary Metropolitan Board of Health:*

Sir: In response to the resolution of the Board, directing "the Chemist to examine the various hair-tonics, washes, cosmetics, and other toilet preparations in general use, and to report what ingredients, if any, they contain, of a character injurious or dangerous to those who use them," I beg leave to submit the following report of the results thus far reached. My examination has been especially directed to the mineral poisons; no tests have been as yet made for vegetable or animal substances, as, for example, cantharides, which I have reason to believe is sometimes employed.

The articles which I have examined may be classed as follows:

I. Hair tonics, washes, and restoratives.
II. Lotions for the skin.
III. Enamels.
IV. White powders for the skin.

I.—HAIR TONICS, WASHES, AND RESTORATIVES.

Of these, sixteen have been examined, and, with but one exception, they have been found to contain lead, generally in the form of acetate, or sugar of lead.

1. "*Hoyt's Hiawatha Hair Restorative.* David Wright, proprietor, 112 South Street, New York."

A colorless liquid, with a black sediment. It is an ammoniacal solution of nitrate of silver, containing 4.78 grains of nitrate in one fluidounce. It contains no other metals.

2. "*Clark's Distilled Restorative for the Hair.* C. G. Clark & Co., proprietors."

A colorless solution, containing in one fluidounce:

Lead in solution	0.11 grain.

3. "*Chevalier's Life for the Hair.* Prepared by S. A. Chevalier, M. D., 1,123 Broadway, New York."

A pale yellow liquid, with a little dark-colored sediment. One fluidounce contains:

Lead in solution	0.22 grain.
Lead in the sediment	0.80 grain.
Total lead	1.02 grains.

4. "*Pearson & Co.'s Circassian Hair Rejuvenator.* Sole proprietors, J. S. Pearson & Co., 286 Jay Street, Brooklyn, N. Y."

A pale-yellow liquid, with a yellow sediment. One fluidounce contains:

Lead in solution	1.40 grains.
Lead in sediment	1.31 grain.
Total lead	2.71 grains.

5. "*Ayer's Hair Vigor.* Prepared by J. C. AYER & Co., Lowell, Mass."

A colorless liquid, with a white sediment. One fluidounce contains:

Lead in solution	2.81 grains.
Lead in the sediment	0.08 grain.
Total lead	2.89 grains.

6. "*Prof. Wood's Hair Restorative.* O. J. WOOD & Co., 444 Broadway, New York, and 114 Market Street, St. Louis."

A colorless liquid, with a yellow sediment. One fluidounce contains:

Lead in solution	2.93 grains.
Lead in the sediment	0.15 grain.
Total lead	3.08 grains.

7. "*The Hair Restorer America.* Prepared by Dr. J. J. O'BRIEN, 202 East Thirtieth Street, New York."

A clear, colorless solution, containing in one fluid ounce:

Lead in solution	3.28 grains.

8. "*Gray's Celebrated Hair Restorative.* Sold by the proprietors, DAY, HOAGLAND & STIGER, 54 Cortlandt street, New York."

A colorless liquid, with a white sediment. One fluidounce contains:

Lead in solution	A trace.
Lead in the sediment	3.39 grains.
Total lead	3.39 grains.

9. "*Phalon's Vitalia.* Prepared by PHALON & SON, 517 Broadway, New York."

Consists of two fluids in separate bottles.

No. 1 is a clear pale-yellow solution of hyposulphite of soda.

No. 2 is a clear pale-pink solution, containing in one fluidounce—

Lead	14.08 grains.

As, by the directions which accompany the package, the lead solution is to be diluted with twice its volume of the hyposulphite solution, the strength of the mixture would be reduced to one-third, when it would contain 4.69 grains of lead in one fluidounce. Prof. Lawrence Reid, the manufacturer's chemist, claims that the hyposulphite of soda renders the lead harmless by ultimately forming with it an insoluble sulphide of lead, and in various other ways. But, after carefully considering all his arguments, I am compelled to say that I cannot accept them as valid.

10. "*Ring's Vegetable Ambrosia.* E. M. TUBBS & Co., proprietors, Peterboro, N. H. A great hair restorative."

A colorless liquid, with a dirty-white sediment. One fluidounce contains:

Lead in the solution	4.69 grains.
Lead in the sediment	0.31 grain.
Total lead	5.00 grains.

11. "*Mrs. S. A. Allen's World's Hair Restorer.* 198 and 200 Greenwich Street, New York, and 266 High Holborn, London, England."

One fluidounce contains:

Lead in solution	5.26 grains.
Lead in the sediment	0.31 grain.
Total lead	5.57 grains.

12. "*L. Knittel's Indian Hair Tonique.* LOUIS KNITTEL, 616 Eighth Avenue, New York."

A pale-yellow liquid, with a pale-yellow sediment. One fluidounce contains:

Lead in solution	5.16 grains.
Lead in the sediment	1.13 grain.
Total lead	6.29 grains.

13. "*Hall's Vegetable Sicilian Hair Renewer.* R. P. HALL & Co., Nashua, N. H."

A pale-yellow liquid, with a pale-yellow sediment. One fluidounce contains:

Lead in solution	6.45 grains.
Lead in the sediment	0.68 grain.
Total lead	7.13 grains.

14. "*Dr. Tebbett's Physiological Hair Regenerator.* TEBBETTS BROS., proprietors, Manchester, N. H."

One fluidounce contains:

Lead in solution	6.82 grains.
Lead in the sediment	0.62 grain.
Total lead	7.44 grains.

15. "*Martha Washington's Hair Restorative.* Prepared by SIMONS & Co., Fitzwilliam, N. H."

A colorless liquid with a yellow sediment. One fluidounce contains:

Lead in solution	3.01 grains.
Lead in the sediment	6.79 grains.
Total lead	9.80 grains.

16. "*Singer's Hair Restorative.* Depot, 643 Broadway and 79 Nassau Street, New-York."

A colorless liquid with a white sediment. One fluidounce contains:

Lead in solution	0.15 grain.
Lead in the sediment	16.24 grains.
Total lead	16.39 grains.

Recapitulation.—Only one of this class of preparations is free from lead, which metal seems indeed to be the *essential constituent.* Most of the sediments observed in the bottles, and which require that the bottle "*be well shaken*," etc., consist of sulphur, which it is intended shall ultimately unite with the lead to produce the dark-colored sulphide of lead, or, as one of the manufacturers has it, "*the original youthful beauty and color.*" The following tabular statement shows how the poisonous hair-fertilizers compare among themselves:

Grains of Lead in one Fluidounce.

Clark's Distilled Restorative for the Hair	0.11
Chevalier's Life for the Hair	1.02
Circassian Hair Rejuvenator	2.71
Ayer's Hair Vigor	2.89
Prof. Wood's Hair Restorative	3.08
O'Brien's Hair Restorer America	3.28
Gray's Celebrated Hair Restorative	3.39
Phalon's Vitalia	4.69
Ring's Vegetable Ambrosia	5.00
Mrs. S. A. Allen's World's Hair Restorer	5.57
L. Knittel's Indian Hair Tonique	6.29
Hall's Vegetable Sicilian Hair Renewer	7.13
Dr. Tebbett's Physiological Hair Regenerator	7.44
Martha Washington Hair Restorative	9.80
Singer's Hair Restorative	16.39

II.—LOTIONS OR WASHES FOR THE COMPLEXION.

1. "*Burnett's Kalliston.* JOSEPH BURNETT & Co., Boston, Mass." Contains no injurious metals.
2. "*Phalon's Paphean Lotion or Floral Beautifier.* PHALON & SON, 517 Broadway." Contains no injurious metals.

3. "*Enamel of America.* **François Gregoire** & Co., corner of Eighth and Locust Streets Philadelphia."

A clear, colorless liquid, containing no injurious metals.

4. "*Email de Paris, de Jared.* **Jared et René**, Paris."

A pink alcoholic liquid, free from injurious metals.

5. "*Balm of a Thousand Flowers.*"

A thick, yellow emulsion, free from injurious metals.

6. "*Perry's Moth and Freckle Lotion.* Dr. B. C. **Perry**, 49 Bond Street, New York."

A colorless liquid with a little white sediment. One fluidounce contains:

Mercury in solution	2.67 grains.
Zinc "	0.99 "

equivalent to

Corrosive sublimate	3.61 "
Sulphate of zinc (crystallized)	4.25 "

The sediment contains a little mercury, lead, and bismuth.

Recapitulation.—With the exception of Perry's Moth and Freckle Lotion, these lotions are entirely free from lead or other injurious metal.

III.—ENAMELS FOR THE SKIN.

1. "*Balm of White Lilies*, for preserving and beautifying the skin. H. A. **Hoadley**, New York."

Water, colored pink, and holding in suspension a large amount of carbonate of lime. It does not contain any injurious metals.

2. "*Dr. Bradford's Enameline for the Complexion.*"

A colorless liquid, holding 33.02 grains of oxide of zinc in suspension in each fluidounce. Is free from lead.

3. "*Hagan's Magnolia Balm*, for beautifying the complexion, etc. **Demas, Barnes** & Co, New York."

A colorless liquid, holding in suspension in each fluidounce 118.61 grains of oxide of zinc. Is free from lead.

4. "*Laird's Bloom of Youth, or Liquid Pearl*, for beautifying and preserving the complexion. Manufactured by **Geo. W. Laird**, 74 Fulton Street, New York."

A colorless liquid, holding in suspension in each fluidounce 169 grains of oxide of zinc. It is free from lead.

5. "*Eugenie's Favorite.* Prepared only by M'lles. T. & L. **Jouvin**, late of Rue St. Anne, Paris."

A colorless solution, holding in suspension in each fluidounce 140.52 grains of carbonate of lead, *white lead*, containing 108.94 grains of metallic lead. There is a trace of lead dissolved in the liquid.

6. "*Snow-White Enamel*, for whitening and beautifying the complexion. **Phalon & Son**, 517 Broadway, New York."

A colorless liquid, holding in suspension in each fluidounce 186.67 grains of carbonate of lead, equivalent to—

Metallic lead in sediment	144.72 grains.
Lead in solution	1.56 grain.
Total lead	146.28 grains.

7. "*Snow-white Oriental Cream*, for whitening and beautifying the complexion. **Phalon & Son**, 517 Broadway, New York."

A colorless liquid, holding in suspension in each fluidounce 246 grains of carbonate of ead, equivalent to—

Lead in suspension	190.22 grains.
Lead in solution	0.77 grain.
Total lead	190.99 grains.

Recapitulation.—The ENAMELS consist of white powders suspended in clear liquids. On standing, the powders subside, but agitation quickly incorporates them with the liquids again. The following contain lead mostly, if not entirely, in the form of *carbonate;* they are, therefore, simply "white lead" ground in water.

Grains of Lead in one Fluidounce, after shaking.

Eugenie's Favorite	108.94 grains.
Phalon's Snow-white Enamel	146.28 "
Phalon's Snow-white Oriental Cream	190.99 "

IV.—WHITE POWDERS FOR THE SKIN.

1. "*John Irvine's Compound Chinese Tablet of Alabaster.*" Consists of carbonate of lime; free from injurious metals.
2. "*Shand's Compound Chinese Tablet of Alabaster.*" Consists of carbonate of lime; free from injurious metals.
3. "*Superior Lily White.* X. BAZIN, Philadelphia." Consists of carbonate of lime and carbonate of magnesia; free from injurious metals.
4. "*Cascarilla de Caracol de Persia.* R. & C. A. WRIGHT, Philadelphia." Consists of carbonate of lime, and some earthy matter insoluble in acids, either clay or "French chalk." Is free from injurious metals.

"*The Original Tablet of Alabaster, or Lily-white Cosmetic.*" Consists of carbonate of lime, with some clay or "French chalk." Is free from injurious metals.

Bismuth Powder, for beautifying the skin and removing freckles." Consists of carbonate of lime with much clay or "French chalk." Is free from injurious metals.

. "*Laird's Lily-white and Rose Bloom.*" Consists of clay or "French chalk." Is free from injurious metals.

Recapitulation.—The white powders consist of carbonate of lime, carbonate of magnesia, clay, or "French chalk," either singly or mixed. Nothing injurious was detected in any one of them.

CONCLUSION.

It appears from the foregoing—

1. With very few exceptions, the HAIR TONICS, WASHES, AND RESTORATIVES, contain lead in considerable quantities, that they owe their action to this metal, and that they are highly dangerous to the health of persons using them.

2. With a single exception, Perry's Moth and Freckle Lotion, the LOTIONS for the skin are free from lead and other injurious metals.

3. That the ENAMELS are composed of either carbonate of lime, oxide of zinc, or carbonate of lead, suspended in water. The first two classes of enamels are comparatively harmless, as harmless as any other white dirt when plastered over the skin, to close the pores and prevent its healthy action. On the other hand, the enamels composed of carbonate of lead are highly dangerous, and their use is very certain to produce disastrous results to those who patronize them.

4. The white powders for the skin are harmless, except in so far as their application may interfere with the healthy action of the skin.

Respectfully submitted:

C. F. CHANDLER, Ph. D.,
Chemist to the Metropolitan Board of Health.

REPORT ON FLUSHING THE STREETS AND SEWERS WITH SEA-WATER.

OFFICE OF THE ENGINEER, METROPOLITAN BOARD OF HEALTH,
301 MOTT STREET, NEW YORK, *October* 13, 1869.

COLONEL EMMONS CLARK, *Secretary of Metropolitan Board of Health:*

Sir: In compliance with the resolution of your honorable Board, "that the Sanitary Engineer be and is hereby directed to report to this Board a plan by which the streets of New York may be flushed daily with sea-water, with estimated expense of the work, and such other facts and details as he may deem important," I herewith submit the accompanying report and plan.

Report.—In consideration of this subject, as the scheme is a perfectly practicable one, the question resolves itself into how can the plan be carried out most economically, both in first construction and in maintenance; how many pump districts it is best that the city should be divided into. The smaller the districts, the less the length of main and branch pipes dependent on one pump, the less the diameter of the pipes and their consequent cost; but the number of engines and stations will be more, the cost of real estate greater, and economy in working engines less. Without applying the test of actual estimate to different plans, I have settled upon the division of the city below Fifty-ninth Street into two districts, the one below, and the other above Fourteenth Street, with a pumping-engine station to each: the lower one at the corner of Canal and Walker Streets, the upper at the Croton Reservoir on Fortieth Street, the general principle being, that a central engine would distribute the water on either side of it, with the same mains and pumps that would be served by two marginal or river stations, which would distribute but to one side. The water to be conveyed to the pumping stations by brick conduits, delivering by gravitation into wells. Both pumping stations have other features to recommend them besides their central positions in their districts. On account of the low level of Canal Street between Centre Street and North River, the influent conduit can be constructed at comparatively small expense; and the angle of Canal and Walker Streets offers great facilities for coal-vaults, engine, pumping and boiler rooms, and for the location of a stand-pipe without expense to the city for real estate. In like manner, unused space beneath the Croton Reservoir at Fortieth Street, will give coal-vault and pumping-engine and boiler-room with no cost but that of adaptation, which will more than offset the extra cost of the influent conduit. In addition with steam-power here located, the extra cost of a supplementary pumping-engine to draw fresh water from the Croton Reservoir, and raise it into an elevated tank for the supply of Murray Hill, would be but comparatively small. The service of this high ground is now an imperative necessity, and there is no more ready means than this for that purpose. It has been adopted by the Croton Department for the supply of the elevated grounds above Manhattanville, and is now being carried out and nearly completed at High Bridge.

District below Fourteenth Street.—There are but few data by which to determine the quantity of water necessary for flushing the streets. It must depend somewhat on the condition of the streets and class of paving grade of streets, and character of inhabitants. I estimate that throughout this district a flow of four gallons per second, or 240 gallons per minute, under the head which would be given by the pumping-engine, would be ample. But as some deduction should be made for the time occupied by the waterman in passing from one hydrant to another in which there is no flow, the constant discharge has been estimated at 200 gallons per minute for a hydrant. It now follows to determine the number of hydrants which will be in use at one time. Below Fourteenth Street the lines of streets measured on the map fall but little short of 120 miles, and the number of intersections of streets is 1,029. By placing a hydrant at each intersection, the average distance under the control of each will be about 600 feet, or, were the intersection uniformly crossing, 150 feet in each direction. If we suppose that twelve minutes would be necessary for the flushing of the street under the command of one hydrant, and in passing to the next, then the total time occupied would be 12.348 minutes, or 204 hours, or 25¾ hours each. It may therefore be said that the force required to flush the city below Fourteenth Street would be 26 gangs, say, of three men each, making eight hours per day, or 78 men. The supply of water required would be 5,200 gallons per minute. In view of the establishment of pumping-engines for flushing purposes, it seems expedient to consider whether there might not be other purposes served at the same time. During the past month the Croton River has been unusually low; most of the city supply has been drawn from the large reservoir in the Central Park, the flow of the river not being equal to the daily consumption of the city. Street sprinkling and sidewalk washing have lately been cut off, and, were it possible, the use of waters for fire purposes would have been stopped; those purposes might be served by the sea-water from the flushing-engines, without the intervention of fire-engines. For fire-engines, I estimate the greatest quantity that would ever be required at any fire, equal to the delivery of seven of the best steam fire-engines discharging 600 gallons per minute, or 4,200 gallons, total, per minute, and there are but few places in the city where the Croton mains have ever furnished, or could furnish, such a quantity within the limits of draft at any one locality.

To recapitulate the data on which the scheme herewith presented has been based, estimated quantity for flushing, 5,200 gallons per minute. Maximum for fire purposes, occasional use, 4,200 gallons per minute.

It is proposed to place the engine-house at the angle of Canal and Walker Streets; the pumping-engines to be two; each to be of daily working capacity of 6,000 gallons per minute; and, in case of need, of strength to distribute 9,000 gallons per minute without risk, one engine only to be in use, the other to be a reserve engine in case of repair or accidents to the first. The pumps deliver the water into a stand-pipe under a head of 100 feet above tide-level;

but this stand-pipe to be high enough for a head of 150 feet. The 100 feet would be the usual working pressure, the 150 feet in cases of very large fires. The stand-pipe to be 4 feet in diameter, with stairs around and to the top of the same, thus adding an architectural feature to the locality. The pumps, to draw their supply by gravitation from a well, fed by a 4-feet brick conduit from the river, to discharge into the stand-pipe, and the distribution thence to be through mains of 20-inch cast-iron pipe, with gradual reduction to 16 inches, 12 inches, 8 inches, and finally, for the last 200 feet, to 6 inches. The cast-iron pipe to be of the heaviest Brooklyn pattern. I proceed to give the cost of construction by estimate and in items, that those conversant with these matters may judge of their correctness:

Real estate and buildings	$125,000
Stand-pipe	50,000
Two engines and boilers at $100,000	200,000
Stand-pipe	20,000
53,500 feet 20 in. pipe at $8.00	428,000
42,250 " 16 " " 5.60	236,600
105,000 " 12 " " 3.60	378,000
105,700 " 8 " " 2.20	232,540
36,200 " 6 " " 1.70	61,540
1,029 hydrants at $45	46,305
Gates	5,000
Total	1,782,985

or say, in round numbers, $2,000,000.

The gross running expenses estimated on the basis of the cost at the Ridgewood pumping-engines, Brooklyn, would be about	$30.00 per day
Seventy-six men at $2.00 per day	152.00 " "
Total	$182.00 " "

The total expense of maintaining the force during the whole year, and when not employed in flushing, attending to cleaning cross-walks, removing snow, and the like, together with the entire pumping expense, and that of superintendence and repairs, would not probably exceed $65,000—thus affording a cheap and more effectual means of cleanliness than any now in use.

District above Fourteenth Street, that is, between Fourteenth and Fifty-ninth Streets.—The number of miles estimated by the length as given in the Directory I find to be 117.4 miles, and the number of hydrants, placing one at each intersection of street and avenue, and one intermediate in the block, is 1,106. By comparison of these figures with those of the district below Fourteenth Street, the difference is so small that it will be perfectly safe to consider the water-supply the same in both districts, and the pumping-engines of same capacity. In fact, taking into consideration the condition of the streets, and the purposes to which the edifices are applied, the water demand, both for flushing and fire purposes, should be less in the upper than the lower. The pumps would therefore be of the same pattern as those in the lower district. But as a stand-pipe might be an objectionable feature at the reservoir, it is proposed to put up an elevated tank over the central façade, either on Fortieth Street or Fifth Avenue, which should be at sufficient height for the flushing service, and an arrangement of valves and air-chambers by which the water-pressure might be increased to any desirable extent in case of large fires. From the tank or rising main, a 24-inch main is laid through Fortieth Street to Lexington Avenue on the east, and Ninth Avenue on the west. From these points the distribution is by 20, 16, 12, 8, and 6 inch pipes, as in the lower districts.

The estimate of cost is as follows:

Alteration beneath reservoir necessary for the reception of pumping-engines and boilers, and coal-space and chimney,	$25,000
Tunnel to East River, 4,200 feet, at $20	84,000
Two engines and boilers, at $100,000	200,000
Tanks and supports, valves, and air-chambers	30,000
5,025 feet 24 inch pipe, at 11.30	56,782
22,960 " 20 " " " 8.00	183,680
19,830 " 16 " " " 5.60	111,048
242,440 " 12 " " " 3.60	872,734
121,500 " 8 " " " 2.20	267,300
36,200 " 6 " " " 1.70	61,540
1,106 hydrants, at 45.00	49,770
Gates	6,000
Total	$1,947,954

The running expenses and cost of maintenance may be fairly reckoned to be the same as in the first district, or $182.00 per day, and yearly $65,000. In total, therefore, cost and maintenance of apparatus for flushing and fire purposes in all that portion of the city below Fifty-ninth Street may be summed up as follows:

Cost of construction below Fourteenth Street	$1,782,985
" " " above " "	1,947,954
Total	$3,730,939

or, in round numbers, $4,000,000.

Cost of daily maintenance below Fourteenth Street	$182
" " " " above " "	182
Total	$364
Cost of maintenance yearly below Fourteenth Street	$65,000
" " " " above " "	65,000
Total	$130,000

As there is some question as to how the cast-iron pipe would endure, subject to the action of salt water, I have sent around to a number of sugar-houses, whose pipes are in use for such purposes, to obtain their experience, and have inquired of others conversant with this matter, and find that the action of rust does not appear to be any more with salt water than with fresh water, and with the present practice of coating all cast-iron pipes with asphalt tar, the destruction of the pipes is a question of no moment.

Under the location of the pumping-station in the upper district, it has been stated that the boilers located beneath the reservoir could be used to supply steam to a supplementary pumping-engine for the water-service of Murray Hill, and, in the small sketch given of the architectural feature for the support of the salt-water tank, it is intended that there should be a fresh-water tank beneath the salt one, of which no estimate of expense has been made.

There are also other purposes to which the salt-water service could be applied besides flushing and fire, which would, it is true, somewhat increase the cost of construction, but by profitable returns would reduce that of maintenance very considerably. I refer particularly to the use of water for the purpose of power, in cases where the cost of attending the engine is large in proportion to the fuel necessary for the power. Throughout the wholesale portion of the city the use of steam-hoists has become almost indispensable—an expedient costly in itself, requiring engines, and boilers, and engine-drivers. For this service alone in a first-class store the expense cannot be estimated at less than $500 per annum, even when used in connection with steam-heating apparatus. At the London and Liverpool docks all hoisting has been done for years by hydraulic hoists, driven by pumps, at the extremities of the docks, with mains along the sides of the docks connecting with the cylinders of the hoist. By the turn of a cock letting on the water, goods are raised from the holds of ships to the wharves, or distributed on the floors of the warehouses. The dock-gates are swung in the same way, and the ships warped out of the docks by hydraulic capstans. In exactly the same way could the goods in our stores and warehouses, and at our docks, be distributed, using the flushing-main as the source of power. If the flushing be done after business-hours, the size of pipes would require less change, dependent on the extent of the application to power purposes. In certain localities the disposition of the pipes would have to be changed, and more laid down, so that no wholesale business street would be without its pipe throughout the extent to which it would be used. No estimate has been made of what would be the expense of such change in mains and pumps as would include the purposes of power with those of flushing and fire. It is only offered as a suggestion that in this way also the use of Croton water, as applied to steam purposes, may be reduced and the works made remunerative.

In conclusion, this report, though not as complete in details as I could have wished, still, I trust, is sufficiently so to show that the scheme is perfectly practicable and well deserving of consideration for its economy of construction and maintenance. With improved system of sewerage and paving, the expense of street-cleaning would be very much reduced, fire-engines done away with, and a much better and a more readily applicable service supplied.

In addition, should it be considered expedient to adopt engines and mains for the purposes of power, the income from the service might soon make the whole apparatus almost self-sustaining, and with economy to the lessees of power.

Respectfully submitted:

W. E. Worthen,

Engineer of the Metropolitan Board of Health.

REPORT OF FOREMAN OF THE DISINFECTING DEPARTMENT.

To E. HARRIS, M. D., *Sanitary Superintendent.*

SIR: I have the honor to submit the following report upon the methods and amount of work in the Department of Disinfection during the past year.

Disinfection of Dwellings.—In all cases of infectious diseases which came to the knowledge of the Sanitary Superintendent, the Foreman of the Disinfecting Department has been notified to have the place visited and disinfectants applied when necessary. During the year 1869, 1,325 houses were disinfected.

Methods.—While the patient is in the room, the disinfection can be only partial. In some cases, when needed, the floor was cleaned and direction given to keep the room ventilated. In nearly every place, diluted carbolic acid was given to the head of the family. An average quantity equal to about two ounces of pure acid was dissolved in water, and then pieces of cloth saturated with this solution directed to be suspended in several parts of the room, in order to keep the air always saturated with the vapors of this disinfectant, and directions were given that this be frequently renewed.

Alleys, yards, cellars, and privies, were disinfected, when found in a bad condition, or always when the patient was sick with typhus or typhoid fever, or cholera morbus.

When the patient died or was removed to the hospital, the disinfection could be done more thoroughly; and in such cases either the whole house, or at least the rooms occupied by the sick, were fumigated with sulphurous acid. For a common tenement-room about two pounds of sulphur are sufficient. Placed in an iron pan, the sulphur is ignited by the aid of a few spoonfuls of alcohol, after having tightly closed the windows and doors leading outside of the infected rooms.

In case a whole house is to be fumigated, about one or two pans for each floor, charged with two pounds of sulphur each, are placed in the halls, all windows being tightly closed and all interior doors of the building opened. A house or rooms to be fumigated should be under this action of the sulphurous acid from two to six hours.

When the rooms to be fumigated are furnished with valuable carpets, gilt ornaments, etc., the only precaution necessary is to secure the entire absence of moisture on them, as the action of the sulphurous acid on the colors or on the gilding depends entirely on the presence of water. When the atmosphere is saturated with moisture, the fumigation cannot well be done in places of the above description. The sulphurous acid will take the water from the air and will fall as a fine dew on the floor and furniture. Fumigation, therefore, is done well only in dry weather.

In cases where the houses could not be vacated in order to be fumigated with sulphurous acid, and yet a more thorough disinfection was needed than we could effect by our common method, I found the following way of operating very effective: In the lower part of the house, according to dimensions, from one to two ounces of carbolic acid, or twice the quantity of the camphor and carbolic mixture, was vaporized by heat, allowing the vapors, through the open door, to enter the hall and stairway. This vaporization is to be renewed every twenty-four or forty-eight hours. This manner of disinfection is evidently more effective than that which depends entirely on the evaporation of the carbolic acid at the temperature of a hallway during the winter, as the disinfection of this part of the building is of great importance.

Clothing is separately disinfected. For this purpose from four to eight ounces of sulphate of zinc and half an ounce of carbolic acid are dissolved in about four gallons of water. Infected clothing has to remain in this solution at least one hour; it is then boiled, and treated as usually after the solution has been removed.

Bedding is disinfected in the same way, but it is difficult to apply disinfectants thoroughly, and we therefore always prefer, whenever it can be spared, to burn it.

The persons in whose dwellings infectious diseases had occurred, and where the Board had performed disinfection, were also advised and required to have the sick-room thoroughly cleaned at the earliest day possible. In these cases the rooms are whitewashed and the floors scrubbed. In very filthy places, the scrubbing had to be done with a solution of chloride of lime. As an abundance of chloride of lime applied on the floors however, might, in very damp places, increase the hygroscopic properties, I advised, in order to meet this exigency, to scrub first with a hot solution of carbonate of soda (washing-soda), and use the chloride of lime by sprinkling it on the wet floor, and then thoroughly scrubbing it with this mixture.

Cellars, yards, and alley-ways are, when necessary, disinfected by sprinkling with chloride of lime.

Privies were formerly disinfected by using the Metropolitan Disinfectant (mixture of perchloride of iron, nine parts, with one part of carbolic acid), but at present mostly by using the heavy oil-of-coal tar. The former is used in a quantity of about half a gallon for an ordinary privy. From three to five quarts of heavy oil are required to disinfect a common privy-vault.

In all cases of typhus, typhoid fever, and cholera morbus, special attention was paid to the disinfection of cellars, yards, and privies. While typhus was prevailing in Eleventh, Twelfth, and Thirteenth Streets, east of First Avenue, all the privies on both sides of these streets were disinfected, and the sewers of them were likewise disinfected with heavy oil-of-coal tar.

The number of privies which were disinfected during the whole year amounts to about two thousand, as not only were privies disinfected in houses where infectious diseases occurred, but also those in the neighborhood whenever the disease appeared to have an epidemic character.

During the summer of the year 1869, the Board of Health ordered streets and gutters to be cleaned, washed, and disinfected regularly, for ten successive weeks. A large number of privies along the streets were then disinfected. During September and the beginning of October, four hundred and sixty-nine privies were thoroughly disinfected.

The following tables will show the amount of work performed during the year 1869, and during the first quarter of the year 1870:

STATISTICAL SUMMARY OF WORK IN THE DISINFECTION OF HOUSES AND PREMISES.

MONTH.	Small-pox, etc.	Typhus and Typhoid Fever.	Fever and Relapsing Fever.	Cholera Morbus.	Whole No. of Visits made.	Rooms Disinfected.	Rooms and Houses Fumigated.	Clothing Disinfected.	Yards and Cellars Disinfected.	Privies Disinfected.
January, 1869	7	23	......	......	30	20	2	23	3	375
February, "	21	12	......	......	30	21	4	8	1	680
March, "	38	10	4	2	54	26	7	6	3	157
April, "	42	15	1	......	58	34	10	8	4	10
May, "	99	6	......	......	105	68	10	16	6	9
June, "	157	4	3	1	165	121	5	30	9	30
July, "	90	2	3	1	99	63	3	3	3	75
August, "	32	2	1	2	37	23	1	5	1	98
September, "	119	1	......	......	120	79	21	44	4	399
October, "	66	3	......	......	69	45	10	18	3	84
November, "	168	1	1	......	170	143	25	43	7	1
December, "	381	6	1	......	388	345	39	73	15	6
January, 1870	489	5	......	......	494	445	59	100	3	7
February, "	424	5	......	......	429	397	56	71	3	4
March, "	462	6	......	......	468	321	85	104	1	109
Total	2,595	101	13	6	2,715	2,151	337	552	66	2044

DISINFECTANTS.—The disinfectants mainly used by the Disinfecting Department of the Metropolitan Board of Health are as follows:

Sulphur.

Carbolic acid (95 per cent.).

Mixture of carbolic acid and gum of camphor (equal parts).

Carbolic acid (70 per cent.).

Heavy oil of coal-tar.

Protosulphate of iron.

Metropolitan disinfecting fluid (a mixture of sesquichloride of iron and carbolic acid).

Sulphate of zinc.

Charcoal dust, and quicklime.

Chloride of lime.

Permanganate of potassa.

Samples of all those substances which are most liable to be adulterated, or to be of inferior quality, have been analyzed by the foreman before purchasing, to determine their value. The disinfecting materials thus tested, were: 1. Carbolic acid, heavy oil of coal-tar, and all other fluids, the value of which depends upon their percentage of carbolic acids; 2. Chloride of lime; 3. Sulphate of iron; 4. Permanganate of potassa. The methods employed in these determinations were—for carbolic acid: 1. Solubility in water. Pure carbolic acid is soluble in large quantity of water; 2. Fractional distillation.

The prices now paid for carbolic acid (95 per cent.) is 50 cents per lb.; for carbolic acid (70 per cent.) 22 cents per lb.; and for dead oil, containing from 5 to 6 per cent. of carbolic acid, 1 cent per lb.

The disinfecting properties of these cheaper mixtures are not entirely dependent upon the quantity of carbolic acid alone, and therefore, for a certain kind of work, they proved to be more effective than could be expected from their percentage of carbolic acid. Another disinfectant, liable to be of inferior quality, is chloride of lime. There was chloride of lime stored at the depot of the disinfecting department, for which the high price of 5 cents per pound had been paid, containing only about 17 per cent. of chlorine.

The chloride of lime, now always on hand at the disinfecting depot, contains from 35 to 36 per cent. of chlorine, and the price paid for it is 3½ cents per pound. Chemical analysis, therefore, not only enables us to form an opinion of the value of disinfectants, for a certain kind of work, but it also gives us the means to obtain always a prizeworthy article for the least money, by comparing real value, and prices of such samples, as have been offered for sale. As the use of a number of disinfectants, contained in the list above given, is not mentioned in my report on the disinfection, I will enumerate them here separately.

The mixture of carbolic acid and camphor is used in all cases where the disagreeable odor of carbolic acid is to be avoided. The fact that a mixture of equal parts of carbolic acid and camphor smells merely of camphor, was first stated by the Sanitary Superintendent, and now proves to be of much practical importance, in the disinfection of apartments inhabited by the better class of citizens. This mixture is used in the same way as carbolic acid.

The heavy oil of coal-tar, as previously stated, is used for the disinfection of privies, but I will also state, that we used it with remarkable success, for the disinfection of gutters, during last summer, when it was sprinkled by means of sprinkling-cans, over the previously cleaned and flushed gutters. Nearly 4,000 gallons were thus used.

Protosulphate of iron, in solution, combined with carbolic acid, was extensively used, as a privy disinfectant. The circumstance, however, that sulphuric acid, after the lapse of three or four weeks, is reduced to sulphuretted hydrogen, made it impractical for use, on account of the very disagreeable and unhealthy odor emitted after such time.

Permanganate of potash, or soda, is a very good disinfectant for clothing, bedding, etc., and this substance can now be procured at a moderate price. It is used in a very dilute solution, for these purposes (1 oz. to 3 gallons of water), but even in this dilute form it acts powerfully on the clothing, discoloring, and soon destroying it. It has therefore in our work been substituted by a solution of sulphate of zinc, containing some carbolic acid, which substances act neither on the color, nor on the fibre of the material to be disinfected.

Results of Chemical Experiments in the Disinfection of Night-soil, and the Scrap from Offal, showing the Degrees of Completeness and Permanency of the

Disinfection.—The following table gives an abstract of the experiments on the deodorization and disinfection of night-soil, and the offal, by Dr. Alsberg, as reported to the Sanitary Superintendent, April 14, 1869.

The solid consistency of the substances to be disinfected made it necessary to add a certain quantity of water, which enables us to obtain a more thorough mixture with the disinfectants.

RENDERING SCRAP.	Water.	Carbolic Acid, 70-per cent.	Sesquichloride of Iron.	RESULTS OBTAINED AFTER STANDING THREE WEEKS.
1,000........	2,580	2.8	....	Slight putrid odor.
1,000........	2,660	5.6	....	Faint odor.
1,000........	2,660	1.4	6.5	Perfectly fresh.
NIGHT-SOIL:				
1,000........	4,250	2.8	....	Disinfection complete.
1.000........	80	....	2.8	" imperfect.
1,000........	80	....	5.6	" tolerably good.
1,000....,...	80	0.77	3.42	" perfect.

Founded upon these experiments, a mixture of sesquichloride of iron and carbolic acid was recommended for the use of night-scavengers. The fluid is called the "Metropolitan Disinfecting Fluid," and is prepared in the following manner. Hydrated sesquioxide of iron (bog-ore from the Staten Island mines) is dissolved in the strongest hydrochloric acid, and, when the latter is perfectly saturated, and the pure sesquichloride of iron has been decanted in proper vessels, about 6 per cent. of carbolic acid is added. The rule adopted is to take about 1 quart of this disinfectant to every load (cubic yard) of night-soil. It is used in the following manner: the disinfectant is mixed before use, with about ten times its volume of water, and then about one-half of this solution is poured upon the contents of the privy, and thoroughly stirred with an implement. About half an hour after this has been done, they begin to empty the privy, gradually using more of the disinfecting material, as they take the soil out. The residue of the disinfectant is then sprinkled over the walls of the vault, to disinfect them thoroughly.

There has been considerable care taken to advise scavengers in the use of this disinfectant, and the whole business is now arranged in such a way, that each scavenger, before he receives his permit, has to show receipts for so many quarts of disinfectants, as he has loads of night-soil to carry away, the number of loads again being verified by the men stationed on the dumping-grounds,

Rivington Street and East River,
Seventeenth Street and East River,
Thirty-eighth Street and North River,
One Hundred and Sixth Street and North River.

The price of the Metropolitan Disinfecting Fluid was fixed at $1.15, and according to this the disinfection costs 29 cents for one load of night-soil, while formerly, by the use of other disinfectants, the price for the disinfection of one load of night-soil came as high as 75 cents. This reduction in the price of disinfectants is not only of material value to the night-scavenger, but is also of advantage to the public, and more to the satisfaction of the Board of Health, as the scavenger, by reason of this moderate price, is less induced to omit the disinfection.

SOME EXAMPLES OF THE APPLICATION OF DISINFECTANTS IN OFFENSIVE MANUFACTORIES.

Distillery 296 *Henry Street, N. Y.*, was seized by the Government in the beginning of the year 1868. The whole establishment was vacated at short notice, and the tanks being partially filled with mash, ready for fermentation. An acid fermentation had set in, during the following summer, filling the entire neighborhood with an abominable sickening smell; nevertheless, this nuisance was not reported to the Board of Health until the summer of 1869. On the 22d of August we proceeded to the place, and, as it was found impossible to get rid of the large amount of fluid by way of the sewer, we pursued the following course.

One and one-half barrels "Warren's dead oil" was first poured into the tanks by means of sprinkling-cans, and well stirred in. The smell from the tanks after this operation was not any more sickening, but merely sour. The experiments upon one of the tanks showed that the quantity of acid was too large to be thoroughly saturated by the quantity of lime at our disposal. We could, therefore, only saturate the upper layers. For this operation the lime was first slacked, then, in a fine powder, thrown upon the surface of the fluid. The result was perfectly satisfactory. No more than 5 barrels of quick-lime was required for this operation.

Bone-black Factory.—October 7th, I visited the establishments of C. Meyer, and Meyer & Wiser, Maspeth, L. I. These factories use only fresh bones, which they receive daily from different slaughter-houses in this city. To free the bones from the fat, they are boiled in water, which process can be conducted without offence. The bones are boiled about 12 hours; the fat is then taken from the surface, and the remaining fluid drawn off by a syphon into a gutter leading to a creek. This gutter may during the summer emit offensive odors, as the fluid passing through is saturated with organic substances, and the gutter is not paved, but merely hollowed out of the ground. There was also a kind of reservoir for this fluid, which acts as a very powerful manure. This reservoir is used, however, only during the winter, and the early part of the spring. From the reasons above mentioned, I recommend that both the gutter and the reservoir be thoroughly covered with "dead oil," to prevent putrefaction. The bones after the boiling process are taken from the kettle, and kept at times for weeks, until they have collected a sufficient quantity to charge a furnace. It is evident that this collection of bones must become offensive during the summer. They were in the habit of using lime as a disinfectant to prevent putrefaction, but, in consequence of a large amount of ammonia being evolved, I recommended that heavy oil of coal-tar should be employed in the place of the lime.

Manure Factory of Geo. W. Baker, Maspeth, L. I.—On the 3d of October, 1869, I visited the manure factory of Mr. Baker, at Maspeth, L. I., for the purpose of ascertaining the facts which caused the neighbors to make complaints to the Board of Health against this place. Baker uses rendering scrap, and mixes the same with soda-ash for the purpose of drying it. The quantity of ammonia developed by the alkali is immense, and saturates the air for a great distance. As the escape of ammonia is not only a nuisance to the neighborhood, but also a considerable loss to the manufacturer, I advised Mr. Baker to use sulphate of lime ("plaster of Paris") for the absorption of the ammonia, with the direction to apply it by covering the heaps of manure which are exposed to the air for the purpose of drying. The result of this manipulation is reported to be very satisfactory.

There were also several places at the establishment which I ordered to be sprinkled with dead oil, to prevent putrefaction of animal matter stored or collecting there.

Ammonia Factory of Edgewater, Staten Island, Superintendent Babcock, was visited by me several times, as it had been reported that the smell arising from this place was at times very sickening. The manufacture of sulphate of ammonia from gas-water can be conducted without causing the least nuisance, when the necessary precautions are taken to condense those substances which would otherwise escape into the air, and become injurious to health. The ammonia in the gas-water is combined with carbonic acid, hydrocyanic acid, sulphocyanic acid, sulphuretted hydrogen, and a number of other substances forming non-volatile compounds with the ammonia. The gas-water is distilled with addition of caustic lime, which latter substance sets the ammonia free. When the quantity of lime is sufficient, only ammonia will escape from the still, which is conducted into a tank containing sulphuric acid. According to the superintendent's statement, from 500 to 600 lbs. of sulphate of ammonia are produced daily. The quantity of lime, which is necessary to liberate a quantity of ammonia equal to that which is contained in the daily product, is at least 300 lbs., while they really use only 150 lbs.

The quantity of lime used in their manner of distilling seems to be adjusted only so as to decompose the non-volatile compounds of the ammonia, while the volatile compounds escape as a whole from the still, and are decomposed in the saturating tank by the sulphuric acid, thus yielding such gases as sulphuretted hydrogen, hydrocyanic acid, etc. To prevent the production of these injurious gases during the day, a condenser is placed between the still and the saturating tank. The fluid therein contained proved on examination to be a very strong solution of carbonate of ammonia, sulphide of ammonium, cyanide of ammonium, etc. The superintendent of the factory claims that he does not make use of that fluid, and that he runs it into the river by means of a hose during high water. As the whole establishment is run on a very economical scale, this seems to be highly improbable, and the only way to get rid of this nuisance, and, besides, to increase the quantity of ammonia salt, in case the superintendent's statement is trustworthy, would be to increase the quantity of lime to such an extent as to decompose all ammonia compounds contained in the gas-water. This was finally recommended to the board for action.

Disinfection of Sewage.—The immense stream of sewage from the sewer outlet near the foot of East Thirty-fourth Street, after having deposited a large amount of filth near its terminus in an open square, flowed a distance of more than 100 yards in the open lots before reaching the river. The ground in front of this outlet being saturated with sewage became so offensive, early in summer, that passengers on the Hunter's Point ferry-boat recognized the approximation to New York by the sickening odor arising from the same. It was not the dirty water itself, but the organic substances deposited, and for a long time accumulated on the bottom, and soaked into the ground, which emitted the stench. We therefore succeeded perfectly by pursuing the following course. The ground in front of the outlet was covered, by means of sprinkling cans, with heavy oil of coal-tar, and subsequently a layer of charcoal-dust thrown over it. The effect was perfect, as the dead oil immediately arrested the foul decomposition of the organic substance in the ground, and the charcoal very completely absorbed the foul gases escaping from the water. The disinfection was repeated at intervals of from two to three weeks throughout the summer.

The same disinfectants were used with satisfactory results on the open lots on Fifty-fourth Street, west of Tenth Avenue, and Sixty-second Street, near Madison Avenue, where stagnant water, remaining there from insufficient drainage of the ground, had become very offensive during the hotter part of summer.

Remark.—Economy in the cost, and accuracy in the methods of disinfection, specially characterize the work in this department of the sanitary service. Simple and positive disinfectants alone are employed; the materials are purchased at the cheapest wholesale prices; the chemical value, or power of each kind of disinfectant, is tested; and all needed precautions are used to prevent needless neutralization by adverse chemical properties.

The business of cleaning, and disinfecting, as conducted in this branch of sanitary duties, is based upon sound principles of chemistry and hygiene which have won the just respect and confidence of the medical profession, and the officers of health; and it is not too much to say, that the Metropolitan Board of Health has contributed its full share to the popular knowledge of this kind of practical chemistry.

Respectfully submitted:

HERMANN ENDEMANN, Ph. D.,
Foreman of Disinfecting Department.

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